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ERRATA.

Page	5	line	40	after " A key to the species " insert " of *Mansonioides* "
,,	7	,,	44	for " *P. canthemerium* " read " *P. cathemerium* "
,,	29	,,	33	,, " Dingler " read " Dinger "
,,	83	,,	1	,, " DINGER (J. F.) " read " DINGER (J. E.) "
,,	128	,,	14	,, " C. H. Bradley " read " G. H. Bradley "
,,	189	,,	18	,, " *Plasmodium praecox* " read " *Plasmodium vivax* "
,,	200	,,	20	,, " BLANC (C.) " read " BLANC (G.) "
,,	216	,,	26	,, " TEGONI (B.) " read " TEGONI (G.) "

IMPERIAL INSTITUTE OF ENTOMOLOGY.

REVIEW
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STRONG (R. P.) ED. **The African Republic of Liberia and the Belgian Congo.**—*Contrib. Dept. Trop. Med. Inst. Trop. Biol. Med.*, v, xxvi+ix+1064 pp., 476 & 28 figs., 9 maps. Cambridge [Mass.], Harvard Univ. Press, 1930. Price, 2 vols. $15.

The first volume of this important work, which is based on the observations made and material collected during the Harvard African Expedition, 1926–1927, gives in its first section a very full account by Dr. R. P. Strong of the Liberian Republic, including a chapter on the insects of that country, chiefly those of medical interest and importance. The second part by Drs. Strong and G. C. Shattuck deals with medical and pathological investigations both in Liberia and in the Belgian Congo, including observations on many diseases of interest to the medical entomologist, such as malaria, yellow fever, sleeping sickness, filariasis and onchocerciasis.

The remainder of this volume and the whole of the second volume are devoted to medical and biological investigations, chiefly to detailed accounts by various authors, of the zoological and botanical results of the expedition. These include a very important work by Dr. J. Bequaert on the blood-sucking Arthropods of this region, more especially the TABANIDAE. A full account is given of the classification of these flies, with keys to the genera of the Ethiopian Region and the species found in the Belgian Congo. Several new species are described. Another paper is one by Prof. G. F. Ferris on some of the ectoparasites of mammals collected, special attention being paid to the TRICHODECTIDAE, of which several new species are described.

The work as a whole is elaborately illustrated and produced and forms a valuable contribution to the subject.

PINTO (C.). **Arthrópodes parasitos e transmissores de doenças. Tomos I & II.** [Arthropods that are Parasites and Vectors of Diseases.] —Med. 8vo, xvi+845 [1] pp., 36 pls., 356 figs. Rio de Janeiro, Pimenta de Mello & C., 1930.

This comprehensive account of the Arthropods that are parasitic on or are actual or potential vectors of diseases of man and domestic animals in Brazil is divided into two volumes, the second dealing with

the Diptera and the first with the remainder of the insects, mites and ticks. A chapter is devoted to each family, the species being dealt with individually, including descriptions of the more important ones and notes on their classification, bionomics and sometimes control. The distribution of the species of many groups, not only in Brazil, but also in other parts of South and Central America, is detailed, with numerous keys. Other sections include a chapter on the rickettsiae and their hosts and a list of works on parasitology in various languages ; each chapter is followed by a bibliography.

v. Mallinckrodt-Haupt (A.). **Milbenerkrankungen beim Menschen. Ein neuer Trombidioseherd in der Eifel.** [Mite Diseases in Man. A new Focus of Trombidiasis in the Eifel District.]—*Dermat. Z.*, lvi, no. 2–3, pp. 98–109, June 1929 ; lvii, no. 3, pp. 191–201, November 1929 ; lviii, no. 1–2, pp. 24–34, 2 figs., March 1930. (Abstract in *Trop. Dis. Bull.*, xxvii, no. 11, p. 922. London, November 1930.)

The first part of this paper is a review of information on Tyroglyphid, Gamasid and Tarsonemid mites that sometimes attack man, and the second and third parts deal almost exclusively with *Trombicula autumnalis*, Shaw, including an account of 8 cases of infestation by this mite observed in Prussia. Brief reference is also made to typhus-like fevers transmitted by other species of *Trombicula* in the tropics. A copious bibliography of the families reviewed is appended.

Elvira (J.). **Nota acerca de los Culicidos encontrados en la cuenca del Ebro.** [The Mosquitos found in the Basin of the Ebro.]—*Med. Países cálidos*, iii, no. 1, p. 63. Madrid, January 1930.

Of the seven mosquitos recorded, *Anopheles maculipennis*, Mg., occurred in all the localities inspected in the basin of the Ebro, and *Aëdes argenteus*, Poir., at Tardienta.

Diaz Florez (A.) & Gil Collado (J.). **Contribución a la biología del** *Anopheles maculipennis* **Meig. Influencia de ciertos factores sobre el número total y relativo de machos y hembras.** [A Contribution to the Biology of *A. maculipennis*. The Influence of certain Factors on the total and relative Numbers of Males and Females.]—*Med. Países cálidos*, iii, no. 3, pp. 193–199, 2 charts, 3 refs. Madrid, May 1930. (With a Summary in French.)

In 1928 a study was made in the Spanish province of Cáceres of the possible factors affecting the absolute and relative numbers of the sexes of *Anopheles maculipennis*, Mg., chiefly in animal quarters at various distances from its breeding-places. It was found that there is a great variation day by day in the percentage of males captured. The number of females appears to vary with the temperature, the maximum being at about 20° C. [68° F.], but this does not apply to the males. Animal quarters built of rubble seem to be more favourable to the latter than those built of timber, more having been found in a shed of the former material despite its somewhat greater distance from the breeding-place. They were more numerous in human dwellings

than in animal quarters, although the former were 550 yards from their breeding-places and the latter only 110. These preferences have a more marked effect on the percentage of males to females than the factor of distance from breeding-places.

de Buen (E.). **Algunos datos sobre biología del** *Anopheles maculipennis* (*claviger*) **en su fase acuática.** [Some Data on the Biology of *A. maculipennis* in its aquatic Phase.]—*Med. Países cálidos*, iii, no. 4, pp. 311–327, 5 figs., 14 refs. Madrid, July 1930. (With a Summary in French.)

An account is given of a number of biological observations made in Spain on the immature stages of *Anopheles maculipennis*, Mg., the results of which are compared with data from the literature. The egg stage lasted from 46 hours at 27°–29° C. [80·6°–84·2° F.] to 72 hours at 22°–25° C. [71·6°–77° F.]. Hibernating adults were released in a cage in November, and eggs were not found until 19th–28th January, at which time a slight rise in temperature occurred and some dead females were noticed on the surface of a tank of water in the cage. In nature, hibernating females laid eggs on warm days, but only a few larvae hatched and these died if the temperature fell. It is probable that eggs found in winter are always recently deposited and not hibernating.

One of the most important factors preventing larval breeding is lack of sunshine on the water, which involves the absence of aquatic plants as well as a lower temperature. It is suggested that the larvae should be divided into two classes, above and below 4 mm. in length, and their relative abundance determined, as dust insecticides that cannot be ingested by the small larvae may then be used for quite short periods, just sufficient to prevent the large ones from pupating. Pupation usually occurs at night or in the early morning. As no pupae were seen in winter, it is assumed that hibernation does not occur in this stage.

de Buen (S.) & de Buen (E.). **Notas sobre la biología del** *A. maculipennis*. [Notes on the Biology of *A. maculipennis*.]—*Med. Países cálidos*, iii, no. 5, pp. 385–393, 1 fig., 9 charts. Madrid, September 1930. (With Summaries in French and English.)

The following data on adults of *Anopheles maculipennis*, Mg., were obtained in dwellings and stables for various domestic animals in the province of Cáceres, Spain. There are 6–7 generations a year, the abundance of mosquitos varying greatly, with two peaks (May–July and October–November). A period of semi-hibernation occurs in which it is possible to find females with developed eggs and even to observe oviposition, but eggs laid in winter did not hatch. During the semi-hibernation period, the mosquitos are not numerous in houses. Their maximum abundance, particularly in dwellings, occurs in the hot months, about the time of the outbreaks of benign tertian malaria in July, and the decrease of disease from October onwards coincides with the decrease of mosquitos in houses and their increase in stables. The mosquitos in stables usually feed and remain there until they are ready to oviposit, but most of those in dwellings leave them to feed.

Of 1,811 mosquitos from both houses and stables examined between 1926 and 1930, only one was infected with malaria. It would therefore seem that the disease is seldom transmitted by mosquitos in dwellings in the localities where these observations were made.

Amelivia (G. G.). **Trabajos antipalúdicos en riegos del Alto Aragón.** [Antimalarial Work in Irrigation Schemes on the Upper Aragon.] —*Med. Países cálidos*, iii, no. 5, pp. 417–438, 9 figs., 4 maps. Madrid, September 1930.

The mosquitos found in the irrigation zone on the Upper Aragon are *Anopheles maculipennis*, Mg., *Culex pipiens*, L., *Aëdes argenteus*, Poir., and *Theobaldia longiareolata*, Macq. The measures that have been adopted against the larvae are the distribution of *Gambusia* and dusting with Paris green, but the work has so far only been carried out on a very small scale.

Wilson (C. J.). **Annual Report of the Malaria Advisory Board for the Year 1929.**—Fol., 12 pp. Kuala Lumpur, 1930.

Both *Anopheles maculatus*, Theo., and *A. vagus*, Dön., have been found breeding in silt and aeration pits on hill-sides and in flat land in Malayan rubber estates, and these pits are considered potentially dangerous breeding-places of Anophelines [*cf.* *R.A.E.*, B, xviii, 256]. The longevity of *A. maculatus* is discussed [*cf.* xviii, 14]. In 1927 and 1928, cases of malaria occurred at Kuala Lumpur in areas where no mosquito breeding-places were to be found, and as adults of *A. maculatus* were caught in the Penang mail train, a systematic search was carried out from January to October 1929 in the trains arriving from Penang and Singapore. Several hundred Anophelines were captured, which belonged to twelve different species, the majority being females.

Wallace (R. B.). **The Use of Plasmochin Compound and Quinine with Indian Labour under Estate Conditions in Malaya.**—*Malayan Med. J.*, v, no. 1, pp. 11–25, 2 figs., 5 charts, 3 refs. Singapore, March 1930.

The results of experiments with labourers in the field show that a combined treatment with plasmochin compound and quinine is valuable as a prophylactic measure against malaria and has a beneficial effect on the general health. Moreover, when optimum conditions for *Anopheles maculatus*, Theo., existed on the estate, and other divisions were suffering from an epidemic of malaria, the labourers treated with a combination of these two drugs remained healthy, although the division was normally one of the two most seriously affected.

Quaife (W. T.). **A Trial of Paris Green as a Larvicide in moving Water in Selangor, F.M.S. With a Summary of previous Work on Paris Green.**—*Malayan Med. J.*, v, no. 1, pp. 26–29, 25 refs. Singapore, March 1930.

During trials of dyes as an aid to inspection of areas dusted with Paris green, it was found that some Anopheline larvae had survived the application of this dust. Experiments were therefore carried out in

1928 and 1929 in open earth drains, some clean and some grassy, filled with slowly moving clear water in an area where *Anopheles maculatus*, Theo., *A. kochi*, Dön., and *A. vagus*, Dön., were known to breed. Paris green was diluted with finely sifted wood ashes and applied once a week. When it was used at the rate of 0·15 to 0·5 cc. in 5 cc. dust per sq. m. of water surface, little diminution in the number of larvae occurred ; at 1 cc. in 5 cc. per sq. m. approximately 50 per cent. of the larvae were destroyed, as compared with those in untreated ditches ; and at 2 cc. all larvae were killed, but this rate is not economic. Thus, apart from the practical difficulty of supervising the application of Paris green, it appears to be of little or no value as a larvicide in inland areas of Malaya where most of the breeding-places of dangerous Anophelines consist of water moving more or less rapidly. A summary of the literature on Paris green [taken largely from this *Review*] is given, and the author concludes that for still waters, especially where there are extensive areas covered with vegetation, Paris green is an economically satisfactory larvicide, but that for moving waters its value as a substitute for oil has still to be proved.

GATER (B. A. R.). **Mosquito Nets.**—*Malayan Med. J.*, v, no. 1, pp. 29–32, 3 figs. Singapore, March 1930.

The author points out that in Malaya, where *Phlebotomus* spp. are very rare and *Culicoides* spp. usually bite during the day, mosquito netting with a mesh of 22/23 holes to the square inch made of 60/100 cotton is sufficient, as it excludes Anophelines and any but exceptional Culicines, and causes much less discomfort than the better quality netting with a finer mesh. The large type of net reaching the floor is more comfortable and convenient than the type that is tucked under the mattress, except in districts where mosquitos are very numerous, or where certain species of Culicines, which will crawl under the edge of the net on the floor, are abundant.

BONNE-WEPSTER (J.). **The Genus** *Taeniorhynchus* **(Arribalzaga) in the Dutch East Indies.**—*Meded. Dienst Volksgezhond. Ned.-Ind.*, Foreign edn., xix, no. 2, pp. 196–212, 10 pls. Weltevreden, 1930. Also in Dutch in *Geneesk. Tijdschr. Ned.-Ind.*, lxx, no. 9, pp. 940–965, 2 pls., 16 figs. Weltevreden, 1st September 1930.

The discovery that certain species of *Taeniorhynchus* are vectors of *Filaria malayi* in Sumatra [*R.A.E.*, B, xviii, 206] increases the importance of this genus. Of the three subgenera, *Taeniorhynchus*, *Mansonioides* and *Coquillettidia*, only the latter two occur in the Dutch East Indies. A key to the species in that region is given, with descriptions of the adults and, in some cases, the larvae and pupae.

MANALANG (C.). **Morphology and Classification of the Philippine Variety of** *Anopheles aconitus* **Dönitz, 1902, and** *Anopheles minimus* **Theobald, 1901.**—*Philipp. J. Sci.*, xliii, no. 2, pp. 247–261, 1 pl. Manila, 1930.

The Philippine Anophelines allied to *Anopheles funestus*, Giles, are discussed. They include *A. minimus*, Theo., which the author agrees with Strickland in treating as a synonym of *A. funestus* [*cf. R.A.E.*, B, xii, 164], and *A. aconitus* var. *filipinae*, n.

MAZZA (S.) & RICKARD (E.). **Relación del cultivo de arroz con la difusión del paludismo en la provincia de Tucumán. (Informe sobre estudios en una estación completa.)** [The Relation between Rice Cultivation and the Occurrence of Malaria in the Province of Tucumán. Report on Studies during a complete Season.]—*5. Reun. Soc. argentina Pat. reg. Norte, Jujuy, 1929,* ii, pp. 707–711, 1 ref. Buenos Aires, 1930.

One year's investigations in Tucumán confirm preliminary observations [*R.A.E.*, B, xvii, 51] that though *Anopheles pseudopunctipennis*, Theo., the principal vector of malaria in Argentina, is found in houses near the rice-fields, the larvae do not occur in the latter but in other breeding-places in the neighbourhood.

LÓPEZ (R. A.). **Contribución al estudio del hábito de vuelo del *Anopheles pseudopunctipennis* en su relación con la lucha antipalúdica en el norte argentino.** [A Contribution to the Study of the Flight Habits of *A. pseudopunctipennis* in its Relation to antimalarial Work in northern Argentina.]—*5. Reun. Soc. argentina Pat. reg. Norte, Jujuy, 1929,* ii, pp. 712–717, 1 plan, 13 refs. Buenos Aires, 1930.

The experiments here described were made in northern Argentina with stained females of *Anopheles pseudopunctipennis*, Theo., in order to ascertain their movements after biting man in dwellings. They indicate that when the mosquitos have fed, they tend to return to the breeding-places from which they originated, possibly in order to oviposit. Of 927 mosquitos thus marked in dwellings, 16 were captured either on the way to or at the breeding-places, at distances up to about 3,000 yards. Only one, which was captured at a distance of about 2,000 yards, was travelling away from the breeding-places and towards another village. Catches in dwellings showed that the mosquitos do not remain there sufficiently long for the development of the sporozoites of malaria (14–15 days).

MAZZA (S.) & CALERA VITAL (F.). **Consideraciones sobre un caso autóctono de paludismo a 3442 metros de altura.** [Notes on a Case of locally acquired Malaria at an Altitude of 3,442 Metres.]—*5. Reun. Soc. argentina Pat. reg. Norte, Jujuy, 1929,* ii, pp. 718–723. Buenos Aires, 1930.

A case of locally acquired malaria is recorded in northern Argentina from near the Bolivian frontier at an altitude of over 11,000 ft. No Anophelines occur there, nor were any found in trains that had passed through malarious localities. Some 50 examples of the Reduviid, *Triatoma infestans*, Klug, were examined, but none harboured malarial parasites.

LÓPEZ (R. A.). **Estudios sobre los hábitos de picar del *Anopheles pseudopunctipennis* en el norte argentino.** [Studies on the biting Habits of *A. pseudopunctipennis* in northern Argentina.]—*5. Reun. Soc. argentina Pat. reg. Norte, Jujuy, 1929,* ii, pp. 724–729, 13 refs. Buenos Aires, 1930.

In northern Argentina 99·3 per cent. of the Anophelines taken in houses by day in 1927 were *A. pseudopunctipennis*, Theo., the remainder

being species of the *Nyssorhynchus* group. The figures in 1926 and 1928 were similar, but catches on a horse showed a larger proportion (38·3 per cent.) of the *Nyssorhynchus* group, *viz.*, *A. albitarsis*, Arrib., *A. argyritarsis*, R.-D., *A. tarsimaculatus*, Goeldi, and *A. rondoni*, Neiva & Pinto. Experiments were made to ascertain if the mosquitos of this group enter houses by night in order to feed and then leave at once, but of 409 individuals caught at night in dwellings, 405 were *A. pseudopunctipennis* and only 4 *A. rondoni*.

DALLAS (E. D.). **Sobre dermitis producida por** *Paederus*. [On Dermatitis due to *Paederus* spp.]—*5. Reun. Soc. argentina Pat. reg. Norte, Jujuy, 1929*, ii, pp. 1163–1167, 2 figs., 10 refs. Buenos Aires, 1930.

Nine species of the Staphylinid genus *Paederus* are known to cause dermatitis in man, and though no case has been recorded from Argentina, seven species of *Paederus* occur there.

JOAN (T.). **El** *Amblyomma* **de Cooper y demás garrapatas de los carpinchos.** [*Amblyomma cooperi* and other Ticks of Capybaras.]—*5. Reun. Soc. argentina Pat. reg. Norte, Jujuy, 1929*, ii, pp. 1168–1179, 11 figs., 2 pls. Buenos Aires, 1930.

In northern Argentina the principal reservoir of *Trypanosoma equinum*, the causal agent of the equine trypanosomiasis known as mal de caderas, is considered to be *Hydrochoerus capybara*, an epizootic among these rodents always preceding one among horses. It is possible that the disease might be transmitted by ticks; those recorded in Argentina from *Hydrochoerus* are *Amblyomma cayennense*, F., *A. dissimile*, Koch, *A. maculatum*, Koch, and *A. cooperi*, Nutt. & Warb. A key to the males of these species is given, together with further notes on *A. dissimile* and *A. cooperi*, which are less well known than the others, including descriptions of both sexes and of the larva and nymph of *A. cooperi*.

HUFF (C. G.). **Individual Immunity and Susceptibility of** *Culex pipiens* **to various Species of Bird Malaria as studied by means of double infectious Feedings.**—*Amer. J. Hyg.*, xii, no. 2, pp. 424–441, 23 refs. Baltimore, Md., September 1930.

Further experiments on the immunity of individuals of *Culex pipiens*, L., to various parasites of bird malaria are described. The mosquitos were fed twice on infected birds, as it was thought that, if susceptibility is an inherent and hereditary characteristic [*cf. R.A.E.*, B, xviii, 96], a non-susceptible individual would resist infection after additional feedings as readily as after the first, and a susceptible individual would be likely to become infected each time it took an infective feed, provided that there was no acquired immunity.

Three species of parasite were used, *Plasmodium elongatum* [xviii, 168], *P. canthemerium* and two strains of *P. praecox* (*relictum*), of which *P. inconstans* [xvi, 61] is now stated to be a synonym. The mosquitos were fed on infected canaries and, after being kept for 5 days with soaked raisins as food, were allowed to oviposit. Within a few days, they were again given access to a bird infected with the same or a different species of parasite. The engorged individuals

were again separated and after 6–7 days were killed, dissected and examined for oocysts. The mosquitos were kept at a temperature of 79–82° F. A young oocyst is easy to distinguish from an old one, and the feedings were so spaced that oocysts from the first feed were more than ten days old, whereas those from the second were six days old or less. Of 678 mosquitos that fed once, only 176, or 25·96 per cent., fed a second time, but 132, or 74·4 per cent., of these lived to be dissected 6–7 days later.

It was found that little or no correlation existed between the susceptibility of individual mosquitos to one species of parasite and their susceptibility to another. The order of feeding did not disturb this general result. Some individuals became infected with two species of parasite, others escaped infection by one and became infected by another, and others escaped infection by both. When the two separate feeds were made on birds harbouring the same species of parasite, the mosquito either became infected both times or remained uninfected, with the exception of two cases out of 60. No evidence of an acquired immunity was noted in the case of two feedings on the same or on different species of parasite. These results taken in conjunction with those previously recorded [xviii, 96] indicate that the susceptibility of a species of mosquito to a given parasite is fairly fixed and permanent in the case of individuals but is not immutable in the case of the species as a whole.

SHANNON (R. C.). **Observations on** *Anopheles pseudopunctipennis* **in Peru.**—*Amer. J. Hyg.*, xii, no. 2, pp. 442–448, 15 refs. Baltimore, Md., September 1930.

From observations carried out between February and August 1928, it appears that *Anopheles pseudopunctipennis*, Theo., is the only Anopheline that occurs in the Rimac Valley, Peru, and presumably, in view of the very similar topographic and climatic features of the region, the only one occurring, at least in any abundance, on the entire western slope of the Peruvian Andes. It is abundant in certain areas of the valley at certain seasons of the year, and the females are often numerous in houses. It was found at an altitude of 7,800 ft. and as far down the valley as Lima. During brief investigations made on the east slope of the Andes, it was found in large numbers in July, the height of the dry season for 1928. Other species belonging to the *Nyssorhynchus* group were also observed, though in much smaller numbers. It is believed that one or more of these replace *A. pseudopunctipennis* as a vector of malaria at lower altitudes, but that the latter, which is known to transmit the disease in other countries, is probably the sole vector on the western slope and the chief one at certain altitudes on the eastern slope.

The temperature on the western slopes of the Peruvian Andes below 8,000 ft. is sufficiently high to permit of insect development throughout the year, so that rainfall is the climatic factor of greatest importance in determining the breeding of *A. pseudopunctipennis.* The rainy season varies according to the altitude. The semi-arid nature of the lower valley (sea-level to 8,000 ft.) definitely restricts the possible breeding area to a narrow elongated strip consisting mainly of the lower half of the river and its tributaries. The preferred breeding-places are pools of fresh water containing an abundance of green algae, which are usually found along the margins of streams and

rivers, in springs, or, when the river is low, in the stream-bed itself. Artificial excavations may also become breeding-places if they contain fresh water. During the dry season, when most if not all of the pools on the lower slopes are dried up or have become polluted, the species is able to maintain itself in the more permanent sources of fresh water found at higher altitudes, and remains in these areas until the rains replenish the breeding-places in the lowlands. The period of greatest abundance occurs between the months of January and June, the rainy season of the higher altitudes.

From these observations a programme of control is suggested, having as its basis the eradication of the species at the higher levels at the middle of the dry season (September–October). The isolation of the valley by high ridges and by extensive arid regions adjoining the lower reaches of the river renders it highly improbable that it would become re-infested from the neighbouring valleys. Such a plan would entail the complete destruction of all breeding-places 6–8 weeks before the rainy season, depending on the length of life of the adult mosquito under dry conditions, so that a very thorough study of the biology of the species is necessary.

Conditions on the eastern slope are entirely different, and in this region *A. pseudopunctipennis* is believed to be confined largely to altitudes between 1,500 and 3,500 ft. above sea level, other vectors being found at 2,500 ft. and below. The high altitudes are comparatively dry, and the rains increase in frequency and volume until along the lower slopes (the upper Amazon basin) rains are almost continuous throughout the year. Breeding reaches its height during the season of least rainfall, which is the only time that suitable pools can form along the rivers. The breeding pools always contain large mats of green algae, which only accumulate when the rivers are low. The breeding-places during the rainy season are unknown ; possibly they occur higher up the mountains. In the vicinity of the Peruvian Corporation Colony, Perené, no larvae of *A. pseudopunctipennis* were observed, but the small streams, lakes, and natural and artificial pools contained larvae of *A. argyritarsis*, R.-D., and occasionally *A. tarsimaculatus*, Goeldi. Local control measures alone are possible in this region. Houses should be built three miles or more from rivers or other large breeding-places. In the zones where *A. pseudopunctipennis* occurs and settlements are situated near rivers, the channels should be kept free from obstruction to prevent the formation of pools, and algae should be destroyed.

Boyd (M. F.). **Studies on the Bionomics of North American Anophelines. VI. Some Observations on Imagines.**—*Amer. J. Hyg.*, xii, no. 2, pp. 449–466, 1 fig., 8 refs. Baltimore, Md., September 1930.

Further investigations in 1927 and 1928 on the local species of Anophelines in North Carolina [*cf. R.A.E.*, B, xvii, 174] are discussed. Routine observations on blood digestion and ovarian development show that during the spring and summer most of the females of *Anopheles quadrimaculatus*, Say, found in houses or stables are freshly engorged or have begun to digest blood ; cases in which digestion was well advanced were less frequently observed. On porches, underneath houses and in privies a large percentage is in the later stages of digestion. In the autumn and winter, most of the females found in unoccupied

houses and tree holes had distended abdomens, and as no gravid females were found during the winter, this must be attributed to hypertrophied fat-bodies in adults undergoing or about to undergo hibernation. No instance of reproductive activity during the coldest winter months was observed. During warm weather this species shows a remarkable tendency to remain near its mammalian hosts until it is ready to oviposit.

The distribution of the various stages of blood digestion in *A. punctipennis*, Say, was similar to that of *A. quadrimaculatus*, but most females of this species observed during the winter with distended abdomens were gravid. Moreover, the fact that individuals in all stages of ovarian development are found throughout the winter indicates reproductive activity during this period. On the other hand, extensive emergence does not apparently occur during the warmer months, and the species appears at this time to be in a condition approaching aestivation. It also shows a tendency to remain near its mammalian host until ready for oviposition, but seldom appeared to have fed on man.

Most of the females of *A. crucians*, Wied., encountered contained fresh blood or had just begun digestion. Very few with advanced ovarian development were found, and no information on the type of shelter used during the development of ova was obtained.

Blood tests showed that most of the females of each species had fed on cattle. In the case of *A. quadrimaculatus* man was the next most common host ; neither of the other species showed such a well-defined preference for any second host, and they do not appear to be implicated in the local transmission of malaria.

Some evidence is submitted to suggest that the presence of cattle in the vicinity of human dwellings at night is associated with a reduction in the incidence of malaria. This is probably accomplished by the diversion of *A. quadrimaculatus* from man to cattle.

ADLER (S.) & THEODOR (O.). **The Exit of** *Leishmania infantum* **from the Proboscis of** *Phlebotomus perniciosus*.—*Nature*, cxxvi, no. 3188, p. 883. London, 6th December 1930.

Fifteen females of *Phlebotomus perniciosus*, Newst., infected with *Leishmania infantum* by feeding on a hamster were allowed to feed 5–13 days later on a solution of citrate by Hertig's method [*R.A.E.*, B, xv, 160]. The ingestion of fluid in this apparatus occurs in some species, but seldom in the case of *P. perniciosus*, though the mouth-parts go through all the actions of piercing. The sandflies were removed from the apparatus after 1–3 minutes, and in 6 cases (9–10 days after the infecting feed) the fluid was found to contain flagellates. The number of these varied from one to hundreds, but in all cases the numbers recovered from the biting parts were very small compared to the enormous numbers afterwards found in the dissected sandflies. The flagellates from the biting parts are sluggish or quite motionless, in contrast to the active ones found in the mid-gut and oesophagus. These observations prove that *L. infantum* can leave the mouth-parts of *P. perniciosus* during the act of biting and enter a new host in the absence of any active interference on the part of the latter. It is suggested that this accounts for the main peculiarity in Mediterranean kala-azar, that is, its relative frequency in infants less than 12 months of age.

Sergent (Edm. & Et.) & Catanei (A.). **Paludisme des oiseaux. Une question de nomenclature. Le nom de** *Plasmodium praecox* **doit-il désigner un parasite du paludisme humain ou un parasite du paludisme aviaire ?**—*Arch. Inst. Pasteur Algérie,* vii, no. 3–4, pp. 223–238, 13 refs. Algiers, 1930.

The authors discuss the arguments for and against the use of the name *Plasmodium praecox* for the parasite of malignant tertian malaria in man, which has since been named *P. falciparum,* and consider that *P. praecox* should be used for this parasite of man and *P. relictum* adopted for that of avian malaria.

Parrot (L.). **Notes sur les phlébotomes. III. 1. Sur** *Phlebotomus sogdianus* **n. sp. 2. Morphologie et répartition géographique de** *Phlebotomus parroti* **Adler et Theodor. 3. Présence de** *Phlebotomus sergenti* **dans le Sahara central.**—*Arch. Inst. Pasteur Algérie,* vii, no. 3–4, pp. 303–309, 3 figs., 10 refs. Algiers, 1930.

As the result of examination of the buccal armature, pharynx and spermathecae of further specimens from Bokhara, *Phlebotomus minutus* var. *sogdianus,* Parr. [*R.A.E.*, B, xvii, 17] is raised to specific rank. The author points out the value of the intromittent organ of the male in the identification of *P. parroti,* Adler and Theodor [xv, 113] and as a diagnostic character in sandflies of the group of *P. minutus,* Rond. A list is given of the localities where *P. parroti* has been taken, from which it appears that it occurs throughout the western basin of the Mediterranean and in North Africa as far as the oasis of El Goléa. The description by H. Foley of three female sandflies taken in the Algerian Sahara [xvii, 82] is completed, and the author concludes that they are *P. sergenti,* Parr.

Shortt (H. E.), Smith (R. O. A.) & Swaminath (C. S.). **The Breeding in Nature of** *Phlebotomus argentipes,* **Ann. & Brun.**—*Bull. Ent. Res.,* xxi, pt. 3, pp. 269–271. London, October 1930.

By means of a flotation technique similar to that used by Young, Richmond and Brendish [*cf. R.A.E.*, B, xiv, 147], soil samples at Gauhati, Assam, were examined for the presence of the larvae of *Phlebotomus argentipes,* Ann. & Brun. Results showed that to fulfil the requirements of a suitable breeding-place, the soil must contain organic material necessary as food for the larvae, it must be reasonably protected from chances of flooding by rain or other water and from thorough desiccation by a hot sun or dry wind, and it must be sufficiently loose to permit of the burrowing of the larvae in search of food. The most common situations fulfilling these conditions and in which breeding was found to be in progress were in the immediate neighbourhood of the walls of dwellings and cattle sheds, both inside and out, and on the sheltered side of and underneath any heaps of miscellaneous débris lying near the houses.

From the middle of December to the middle of February, *P. argentipes* is very rarely found in nature, but larvae have been obtained from known breeding sites and there is no doubt that it is in this stage that the sandfly exists during the coldest months of the year. Food is usually found in the intestines of the larvae, indicating that there is no true hibernation, but merely a slowing down in the rate of development.

Ruttledge (W.). **Notes on** *Argas brumpti* **(Acarina).**—*Bull. Ent. Res.*, xxi, pt. 3, p. 273, 2 refs. London, October 1930.

In the nymphal and adult stages *Argas brumpti*, Neum. [*cf. R.A.E.*, B, ii, 50 ; iii, 228] has a wide range of hosts, but those of the larvae are much more restricted. Larvae have been reared to maturity on guinea-fowl, *Numida meleagris* [iii, 228], but examinations of numbers of these birds in districts in which the tick occurs do not support the theory that they are the usual host of the larvae. Early in 1928 the author observed in the Nuba Mountains, Sudan, that a common species of rock lizard, *Agama colonorum*, was usually infested with larval ticks, and in March almost every animal examined bore 2–3, and occasionally as many as 10, larvae of *A. brumpti* attached to the loose skin of the head and neck. Later in the year the lizards seemed to be free from infestation. It seems probable therefore that *A. colonorum* and possibly allied lizards are the normal hosts of the larvae of *A. brumpti*. The author records the fact that a female of *A. brumpti*, taken as an adult in August 1918, was still alive in April 1930.

Edwards (F. W.). **Mosquito Notes.—IX.**—*Bull. Ent. Res.*, xxi, pt. 3, pp. 287–306, 8 figs. London, October 1930.

For the tribe Anophelini Christophers admitted only one genus *Anopheles*, with five subgenera, namely, *Anopheles* (*s. str.*), *Nyssorhynchus*, *Myzomyia*, *Bironella* and *Chagasia*. The author considers *Chagasia* generically distinct from *Anopheles* and is also inclined to regard *Bironella* as a distinct genus, with the subgenera *Bironella* (*s. str.*) containing *B. gracilis*, Theo. (*Anopheles bironelli*, Chr.) and *B. papuae*, Swell. [*cf. R.A.E.*, B, xviii, 207] and *Brugella*, subgen. n., containing *B. travestitus*, Brug [xvii, 111]. He also regards *Stethomyia* as a distinct subgenus of *Anopheles*, including the single species, *A. nimbus*, Theo. Descriptions are given of *A. nimbus* var. *kompi*, n., from Panama, *A. walravensi*, sp. n., from the Belgian Congo, *A. multicinctus*, sp. n., from Kenya Colony, and *A. garnhami*, sp. n., from Kenya Colony and the Belgian Congo. Notes are given on various Culicine mosquitos, and eleven new species are described.

Taylor (A. W.). *Glossina palpalis* **and Sleeping Sickness at Ganawuri, Plateau Province, Northern Nigeria.**—*Bull. Ent. Res.*, xxi, pt. 3, pp. 333–340, 3 pls., 1 map, 2 refs. London, October 1930.

During November and December 1929, investigations on the bionomics of *Glossina* were undertaken at Ganawuri in the Plateau Province of Northern Nigeria, where a severe epidemic of sleeping sickness was in progress. *G. palpalis*, R.-D., which is the only tsetse-fly in this district, is found during the wet season (April to October) along the base of the escarpment at the various village streams, which are then in flood, and follows the shade lines up the hill-sides into the villages. At the time of the investigations it was taken at a permanent stream with dense forest on its banks, which forms the only true primary focus of the fly in this district, and at four hill streams that were still flowing. It was most numerous at path crossings and village watering places, even though shade at these points was frequently scanty. Densely shaded ravines containing abundant water but

unfrequented by man and domestic animals may, on the other hand, be entirely free from fly. Game is absent, and except in one locality where aquatic reptiles (probably *Varanus* sp.) occur, *G. palpalis* feeds exclusively on man and domestic animals, including sheep, goats, dogs and horses. In Northern Nigeria it normally obtains a considerable proportion of its food from reptiles, chiefly *Varanus* and crocodile [*cf. R.A.E.*, B, xi, 117]. Evidence is presented to show that almost half the flies containing mammalian blood had fed on man. On dissection, 9 out of 236 flies were found to contain *Trypanosoma gambiense*, and one of these infections was mature, parasites being found in the gut, proventriculus, salivary glands and hypopharynx. This is believed to be the highest infection rate recorded for this trypanosome in wild flies. It is probable that during the rainy season, when conditions are more favourable for tsetse, the life of the fly longer, and contact with man even closer, the infection rate would be increased. In 141 flies from the locality in which shade was abundant and aquatic reptiles were present as an alternative source of food, no trypanosomes were observed.

The absence of game and aquatic reptiles and the localisation of shade in and near villages has produced an abnormally close contact between man and fly, and the introduction of a virulent strain of *T. gambiense* (probably from a notorious sleeping sickness centre south of the plateau) resulted in the epidemic. Transmission of the disease is by cyclically infected individuals of *G. palpalis*, the high infection rate in the fly compensating for its general scarcity.

Owing to the impracticability of protective clearing in this area and the impossibility of inducing any but a very small proportion of the natives to take a full course of treatment, it was decided to remove the entire population from the hills to the uninfested river plain. Suitable sites, at a minimum distance of 2–2½ miles from the hills, were chosen, and by April 1930 most of the new villages were completed. It is anticipated that by thus breaking the contact between man and fly and by continued treatment of existing cases the epidemic will be controlled.

Bedford (H. W.). **The Distribution of Tsetse-flies in the Sudan.**—*Bull. Ent. Res.*, xxi, pt. 3, pp. 413–415, 5 maps, 8 refs. London, October 1930.

Five species of *Glossina* have been found in the Sudan, namely *G. palpalis fuscipes*, Newst., *G. morsitans*, Westw., *G. longipennis*, Corti, *G. fusca*, Wlk., and *G. fuscipleuris*, Aust., of which the first four are known to be carriers of trypanosomiasis. The distribution of each species is discussed and illustrated in a series of maps.

Harris (R. H. T. P.). **Report on the Bionomics of the Tsetse Fly** (*Glossina pallidipes* **Aust.) and a preliminary Report on a new Method of Control, presented to the Provincial Administration of Natal.**—Fol., 75 pp., 5 figs., 10 diag. Pietermaritzburg, June 1930.

The second part of this paper (pp. 7–75) is a detailed report of studies on the bionomics of *Glossina pallidipes*, Aust., carried out in Zululand

from 1921–1926, a summary of which has already been noticed [*R.A.E.*, B, xvi, 129].

In the first part (pp. 3–6), the main results obtained in the above studies are briefly summarised, and their bearing on the possibility of controlling or exterminating the fly is discussed. It was decided in 1929 that if the game reserves were to be retained and the animals and consequently the fly concentrated therein, it would be necessary to reduce the numbers of the commoner and more prolific animals, which besides supplying food to an increasing number of flies, also caused the rarer species of game to migrate from the reserves owing to the diminution of grazing and thus exposed them to destruction. During the period of destruction of the commoner animals, experiments were carried out to devise some satisfactory means of controlling the fly after the reduction and concentration of the game had been carried out. As the reproductive rate of the fly is remarkably low, any satisfactory and economical method of fly destruction should have a beneficial effect. Flies had already been attracted to inanimate decoys of various designs [xiii, 192]. In laboratory tests it was found that extract of pyrethrum brought about paralysis of the locomotor centres of the insect when the pulvilli of its feet came into contact with the drug, the fly succumbing or recovering according to the strength of the preparation. Veratrine and delphinine (the alkaloids extracted from the seeds of *Sabadilla* and *Staphisagria* respectively) gave similar results, the most satisfactory mixture being veratrine and coconut oil (5 : 100). When the mixture was applied with a brush to the stomach and legs of a live animal, the flies attacking it were so rapidly affected that none drew blood or remained longer than a few seconds on it. The mixture was effective for about 48 hours, and during this period many dead or dying flies were found on the vegetation where the animal had stood. It was also tried on a dummy animal, but in both cases the difficulty of maintaining an even film on the surface of the hair under the varying temperatures experienced in the bush led to the conclusion that this method was not satisfactory for work on a large scale. Finally, traps of various types were designed, which have proved very satisfactory (but are not described). The catches vary considerably with the weather. In every case the number of females caught has been greatly in excess of the males, but whether this is due to the particular environment in which the traps are erected or to some feature of the trap itself has not been discovered. In one trap a total of 2,997 flies was captured in 24 consecutive days, of which 2,616 were females and 481 were males. It is hoped later to give details of a trap that will only cost a few shillings. The traps need practically no attention other than the periodical removal of flies, and it is anticipated that if operations are conducted on a sufficiently large scale the extermination of *Glossina* may eventually be accomplished.

HIRST (L. F.). **Rat Flea Surveys.**—*Rep. Med. Off. Hlth. Colombo 1929*, xxiv, pp. 41–42. Colombo [1930].

A rat and rat-flea survey of grain ships entering Colombo Harbour carried out from 1st October 1928 to 30th September 1929 showed a uniformly high percentage of *Xenopsylla cheopis*, Roths., on both *Mus* (*Rattus*) *rattus* and *M.* (*R.*) *norvegicus* and a remarkably high

proportion of *M. norvegicus*. In connection with a flea survey of Ceylon, preliminary surveys at a number of centres indicate that the low country wet zone as a whole is an area of *X. astia*, Roths., that has so far resisted penetration by *X. cheopis*, a species of rat flea associated in Colombo with wholesale imports from infested territories abroad. In the up-country localities surveyed four foreign species of flea occur on rats, namely, *X. cheopis* (Indo-Africa), *Leptopsylla segnis*, Schönh. (European mouse flea), *Ctenocephalides* (*Ctenocephalus*) *felis*, Bch. (European cat flea) and *Echidnophaga gallinacea*, Westw. *X. cheopis* is the most prevalent species at elevations between 1,600 and 5,000 ft. The indigenous fleas of field rodents in this region are probably *Ceratophyllus tamilanus*, J. & R., and *Stivalius phoberus*, J. & R., the others being regarded as comparatively recent introductions. Surveys at elevations of 5,000 and 6,000 ft. confirmed the author's prediction that *X. astia* would be comparatively scarce at elevations above 4,000 ft. Conditions become relatively unfavourable for *X. cheopis* at 6,000 ft. Judging from epidemiological evidence collected on a world-wide basis, the belt of hill territory in the Central Province lying between 2,000 and 4,000 ft. presents climatic conditions more favourable to the endemicity of plague than are to be found in any other parts of Ceylon, and it is significant that *X. cheopis* seems to be more abundant on the rats of this region than on those of any other surveyed up to the present. Details of the flea surveys of Colombo undertaken in 1920–24 and in 1928–29 are shown in tables [*cf. R.A.E.*, B, xviii, 121].

Blanc (G.) & Caminopetros (J.). **Sensibilité du spermophile de Macédoine** (*Citillus citillus*) **au kala-azar méditerranéen.**—*C.R. Acad. Sci. Fr.*, cxci, no. 18, pp. 800–802. Paris, 1930.

The authors' experiments showed that the Macedonian ground squirrel, *Citellus citellus*, is very readily infected with Mediterranean kala-azar by any method of inoculation, whether the disease originated from man or dogs, but was not similarly infected with oriental sore. This supports the view that infantile and canine kala-azar are identical. The blood of the ground squirrel becomes very rich in parasites, so that it would be suitable for use in studying the relation of blood-sucking Arthropods to the disease.

Papers noticed by Title only.

Phillips (J. F. V.). **The Application of ecological Research Methods to the Tsetse** (*Glossina* **spp.**) **Problem in Tanganyika Territory: a preliminary Account.**—*Ecology*, xi, no. 4, pp. 713–733, 11 refs. Brooklyn, N.Y., October 1930. [*Cf. R.A.E.*, B, xviii, 61, 160.]

Ferris (G. F.). **Sixth Report upon Diptera Pupipara from the Philippine Islands** [Hippoboscidae].—*Philipp. J. Sci.*, xliii, no. 4, pp. 537–553, 7 figs. Manila, December 1930.

Dodd (A. P.). **New Hymenoptera Proctotrypoidea from Victoria** [including a Description of the Male of the Diapriid, *Hemilexomyia abrupta*, Dodd, a Parasite of Sheep-maggot Flies].—*Proc. Roy. Soc. Vict.*, xliii, pt. 1, pp. 26–35. Melbourne, September 1930.

Kröber (O.). **Die südamerikanischen Arten der Gattung** *Scione* **Wlk.** (=*Rhinotriclista* **End.**) **(Dipt.).**—*Stettin. ent. Ztg.*, xci, no. 2, pp. 141–174, 12 figs. Stettin, 1930.

Bustos (F.). **Dos casos de miasis vulvar** [in Argentina, one case due to *Cochliomyia macellaria*, F.].—*5. Reun. Soc. argentina Pat. reg. Norte, Jujuy, 1929*, ii, pp. 1149–1152, 1 fig., 4 refs. Buenos Aires, 1930.

Mazza (S.), Parodi (S.) & Smith (C. M.). **Miasis ocular por larva de** *Sarcophaga* **sp.** [in Argentina].—*5. Reun. Soc. argentina Pat. reg. Norte, Jujuy, 1929*, ii, pp. 1157–1159, 3 figs. Buenos Aires, 1930.

Giacomelli (E.). **Notas lepidopterológicas sobre especies nuevas o poco conocidas, incluso especies con larvas urticantes de Capilla del Monte, Provincia de Córdoba (Rep. Argentina).** [Lepidopterological Notes on new or little known Species, including Species with urticating Larvae [*Automeris capillensis*, sp. n.] from Capilla del Monte, Province of Cordoba, Argentina.]—*5. Reun. Soc. argentina Pat. reg. Norte, Jujuy, 1929*, ii, pp. 1180–1185, 2 figs., 1 pl. Buenos Aires, 1930.

da Costa Lima (A.). **Nota sobre a** *Wyeomyia* (*Dendromyia*) *luteoventralis* **Theobald, 1901.** [A Note on the systematic Position of *W.* (*D.*) *luteoventralis*, Theo., of which *W. bromeliarum*, D. & K., is considered a Synonym.]—*Mem. Inst. Oswaldo Cruz*, xxiv, fasc. 1, pp. 35–39, 2 pls. Rio de Janeiro, 1930.

da Costa Lima (A.). **Sobre especies do genero** *Miamyia*, **subgenero** *Miamyia* **(Diptera : Culicidae).** [Species of *Miamyia*, Subgenus *Miamyia*, from Brazil.]—*Mem. Inst. Oswaldo Cruz*, xxiv, fasc. 2, pp. 73–78, 3 pls. Rio de Janeiro, 1930.

De Rook (H.) & Soesilo (R.). *Anopheles* (*Bironella*) *papuae.—Meded. Dienst Volksgezondh. Ned.-Ind.*, Foreign edn., xix, no. 2, pp. 213–218, 6 figs. Weltevreden, 1930. [See *R.A.E.*, B, xviii, 207.]

Soesilo (R.). **A short Supplement to De Rook and Soesilo's Article about** *Anopheles papuae.—Meded. Dienst Volksgezondh. Ned.-Ind.*, Foreign edn., xix, no. 2, pp. 219–220, 1 fig. Weltevreden, 1930. [See *R.A.E.*, B, xviii, 233.]

Brug (S. L.) & Haga (J.). **Notes on the** *Sarcoptes* **found in a Case of Scabies crustosa and in a Case of Scabies in a Monkey.**—*Meded. Dienst Volksgezondh. Ned.-Ind.*, Foreign edn., xix, no. 2, pp. 221–226, 5 figs., 10 refs. Weltevreden, 1930. [*Cf. R.A.E.*, B, xviii, 247.]

Donatien (A.) & Lestoquard (F.). **De la classification des piroplasmes des animaux domestiques.**—*Rec. Méd. Vét. exot.*, iii, pp. 5–20, 2 figs. 1930. (Abstract in *Trop. Vet. Bull.*, xviii, no. 4, p. 117. London, December 1930.)

Sharif (M.). **A Note on Monstrosities observed in Ixodid Ticks.**—*Rec. Ind. Mus.*, xxxii, pt. 2, pp. 107–112, 1 pl., 6 figs. Calcutta, July 1930.

[Golov (D. A.) & Knyazevskiĭ (A. N.).] Golow (D.) & Knjasewskii (A.). **Ueber die Rolle der Ektoparasiten eines leeren Nestes des Ziesels** (*Citellus pygmaeus*) **in der Epidemiologie der Pest.** [On the Rôle of the Ectoparasites (Fleas and Ticks) in an empty Nest of the Ground Squirrel, *C. pygmaeus*, in the Epidemiology of Plague in Kazakstan.]—*Zbl. Bakt.*, (1, Orig.) cxviii, no. 5–6, pp. 277–283. Jena, October 1930. [See *R.A.E.*, B, xviii, 270.]

Jordan (K.). **On some South African Fleas.**—*Novit. Zool.*, xxxvi, no. 1, pp. 129–138, 7 figs. London, 15th November 1930.

De Meillon (B.). **A new** *Xenopsylla* [*lobengulae*, sp. n.] **from South Africa.**—*Novit. Zool.*, xxxvi, no. 1, pp. 139–142, 10 figs. London, 15th November 1930.

ESKEY (C. R.). **Chief etiological Factors of Plague in Ecuador and the antiplague Campaign.**—*Publ. Hlth. Rep.*, xlv, no. 36, pp. 2077–2115, 2 pls., 1 map, 1 diag.; no. 37, pp. 2162–2187. Washington, D.C., 1930.

A detailed account is given of a plague survey in Ecuador, with particular reference to the town of Guayaquil, the source from which all plague epidemics in the central part of the country are derived by means of infected rats carried on the Guayaquil and Quito railway. *Xenopsylla cheopis*, Roths., is the most important flea transmitting plague to man and the only vector among rats. It is the only rat flea found in the lowlands and in the mountains up to an altitude of 4,000 ft. It is implicated in epidemics at altitudes up to about 8,500 ft. and is found at altitudes of over 9,000 ft., but in numbers insufficient to cause epidemics, although plague occurs in Ecuador at altitudes above 10,000 ft. The constant importation of infested rats is probably necessary to maintain this flea in sufficient numbers in the high altitudes for it to cause epidemics. It may reproduce when the mean temperature is between 55 and 56° F., but a mean high temperature of about 70° or higher is necessary. Plague does not persist in the mountain towns after June or the onset of the colder weather. Dampness caused by the rainy season is the chief factor in reducing the *cheopis* index. In Guayaquil under normal conditions 75–80 per cent. of the rats trapped are *Mus* (*Rattus*) *norvegicus*, 15–20 per cent. *M.* (*R.*) *rattus* and 5–10 per cent. *M. rattus alexandrinus.* The *cheopis* index of the last two is higher than that of *M. norvegicus*, though very young individuals of this species have a higher index than any other group of rats. The efficiency of poison in killing rats may be observed by following the total and the female *cheopis* index, which both increase when poison is employed.

The following fleas were found during the survey: *X. cheopis, Pulex irritans*, L., *Ctenocephalides* (*Ctenocephalus*) *felis*, Bch., *C.* (*C.*) *canis*, Curt., *Rhopalopsyllus cavicola*, Weij., *Hectopsylla suarezi*, Fox, *Leptopsylla segnis*, Schönh. (*musculi*, Dug.) and *Ceratophyllus londiniensis*, Roths. *P. irritans* is the only flea, other than *X. cheopis*, concerned in the transmission of plague in man, and is probably responsible for nearly all cases in the high mountain districts where the latter does not occur, and for some of the cases in localities where *X. cheopis* is the chief vector. It seems probable that plague transmitted by *P. irritans* does not produce such a high rate of mortality as that carried by *X. cheopis*. *P. irritans* is, moreover, the probable agent involved in the production of the two unusual types of plague found in Ecuador, namely " viruela pestosa " (a vesicular form) and " angina pestosa " (a tonsillar form). *Pediculus humanus*, L. (*corporis*, DeG.) and *P. capitis*, DeG., may be responsible for some cases of plague, particularly " angina pestosa," which is due to the practice of the natives of killing infected vermin between the teeth. *X. cheopis* only occurs in small numbers on mice (*Mus musculus*), and these animals are of very little importance in relation to plague.

The second part of the paper deals with the destruction of rats. It is estimated that the incidence of plague was reduced by 80 per cent. during the months of January, February and March 1930 by a campaign in which the continued use of poison was supplemented by trapping. If an active campaign is maintained in Guayaquil, it seems probable that plague will be eradicated and as a consequence will disappear from all other parts of central Ecuador.

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NICOLLE (C.), ANDERSON (C.) & COLAS-BELCOUR (J.). **Recherches expérimentales poursuivies à l'Institut Pasteur de Tunis, sur les conditions de la transmission des spirochètes récurrents par les ornithodores.—Mémoire d'ensemble.**—*Arch. Inst. Pasteur Tunis*, xix, no. 2, pp. 133–227. Tunis, June 1930.

Information on experiments dealing with the conditions of transmission of relapsing fever spirochaetes by *Ornithodorus* spp. and described in a series of preliminary papers [*R.A.E.*, B, xiv, 168; xvi, 2, 3; xvii, 17, 18, 62] is collated and rearranged, with certain additions, in a manner that renders it more readily comprehensible, the conclusions being in each case confirmed and amplified.

That these ticks are all capable of transmitting any spirochaete has been clearly demonstrated, the only condition being that they must encounter the spirochaetes in sufficient numbers in the blood of their host. Failure to secure experimental transmission of *Spirochaeta gondii*, and to a certain extent of *S. normandi*, is explained by the rare occurrence of these spirochaetes in the animals they infect. It is quite evident that, irrespective of the rarity of the spirochaete in the blood, permanent contact between tick and spirochaete in nature will finally result in the infection of the tick.

A tick becomes infected irrespective of its stage of development, and the infection will persist throughout its life. The total life of a tick, kept in captivity and regularly fed, does not appear to exceed 20 months. The longest intervals at which transmission has been effected by means of inoculation of the crushed remains of infected ticks have corresponded with the average life of the tick, the results being identical whether the spirochaete was of the species normally transmitted by the tick or not. The experiments indicate no difference in the reaction of the male and female tick to infection.

Only one exception has been observed to the rule that ticks having acquired infection in the adult stage are unable to transmit it by the bite, *S. hispanica* and *S. duttoni* having been successfully transmitted by *Ornithodorus savignyi*, Aud., infected in the adult stage. About 50 per cent. of the animals subjected to the first feed of ticks infected in the nymphal stage do not become infected, indicating that a certain lapse of time is necessary for the spirochaete to produce new and virulent forms within the nymph. The minimum is probably 6 days. Feeds subsequent to the first infective one are usually infective during a period of some months, but are not regularly so. Negative feeds appear sooner or later, and they become increasingly frequent until finally positive feeds cease entirely; they do not occur in the adult stage.

The duration of infectivity of the ticks by biting thus corresponds with the time they take to transform from the nymphal to the adult stage. This varies according to the species and conditions of nourishment, but does not usually exceed 5–6 months. It has, however, been known to be extended until the fifteenth month, once with *O. erraticus*, Lucas, and *S. hispanica*, and once with *O. savignyi* and *S. normandi*; and even to the seventeenth month in the case of *O. savignyi* and *S. hispanica*. *O. moubata*, Murr., and *O. savignyi* behave similarly in this respect and react similarly to all spirochaetes. *O. normandi*, Larr., on the other hand, although liable to preserve infection with various spirochaetes for a considerable time, only transmits it by bite during a short period. When a natural or hereditary infection is strengthened

by an infective feed, the bites become regularly more virulent, and their infective power is prolonged. There is no indication that the ticks immunise themselves by repeated re-infection.

Infection is inherited by the offspring of ticks infected in the nymphal or adult stage, but again is only transmitted by nymphs. The first two or three feeds do not always produce infection, and the ticks are not uniformly infective, it being probable that the granular forms of the spirochaetes are not evenly distributed in the ovaries of the parents. Inheritance and transmission of infection by the second generation, although liable to occur, is much more rare, particularly in the case of a spirochaete with which the tick is not habitually associated. Infection of the third generation has been recorded by other workers, though only in cases of spirochaetes naturally transmitted by the ticks concerned.

PORTER (A.). **Cockroaches as Vectors of Hookworms on Gold Mines of the Witwatersrand.**—*J. Med. Ass. S. Afr.*, iv, no. 1, pp. 18–20. Cape Town, 11th January 1930.

Of 97 individuals of *Periplaneta americana*, L., collected in gold mines in the Transvaal at depths of 4,000–5,500 ft., where conditions are hot and moist, 8 were found to contain larvae or ova of the hookworm, *Ancylostoma duodenale*, and ova were also found in their faeces. Negative results were obtained on dissection of 221 individuals of *Blattella germanica*, L., collected from mines either below the surface or above ground. A list is given of the various protozoa and helminths found during the course of these dissections, including larvae resembling those of *Gongylonema* (*Spiroptera*) *neoplasticum* found in four individuals of *P. americana*, three of which came from mines [*cf. R.A.E.*, B, xiii, 156, etc.], and larvae of *Moniliformis moniliformis* found in one individual of the same species.

FLETCHER (T. B.) & SEN (S. K.). **A veterinary Entomology for India, IX-XI.**—*J. Cent. Bur. Anim. Husb. Dairying India*, iii, pt. 2, pp. 50–57, 3 pls.; pt. 3, pp. 95–100; iv, pt. 1, pp. 1–5, 3 pls. Calcutta, July & October 1929, & April 1930.

In part IX of this series [*cf. R.A.E.*, B, xvii, 103, 168], a key is given differentiating the Hippoboscid genera, *Hippobosca*, *Pseudolynchia*, *Lipoptena* and *Melophagus*, which are likely to come to the notice of veterinarians in India. Notes are given on *H. maculata*, Leach, on cattle and horses, *H. capensis*, Olfers, on dogs, *H. camelina*, Leach, on camels, *P. maura*, Big., on pigeons, *L. caprina*, Aust., on goats, and *M. ovinus*, L., on sheep.

Part X briefly discusses reproduction in insects, parasitism, symbiosis, warning colours, protective resemblance, mimicry and tropisms.

The Oestrids are dealt with in Part XI, the genera occurring in India being *Hypoderma*, *Oestrus*, *Gastrophilus*, *Cephalopsis*, *Cobboldia* and *Gyrostigma*. The last two are each represented by a single species, *C. elephantis*, Steel, from the Indian elephant, and *G. sumatrensis*, Br., recorded from the Sumatran rhinoceros in Assam. Keys are given to the other four genera and to the species of *Gastrophilus*, together with very brief notes on *O. ovis*, L., in sheep and goats, *Cephalopsis titillator*, Clark, the larva of which fairly frequently occurs in the naso-pharynx of camels, *H. lineatum*, Vill., in cattle and

occasionally in goats, *H. crossi*, Patt., in goats and occasionally in cattle, *G. intestinalis bengalensis*, Macq., and *G. crossi*, Patt. (which has not been recorded since it was described [*R.A.E.*, B, xii, 62]), attacking horses, and *G. nasalis*, L., and *G. pecorum*, F., which have been recorded from horses and the latter from a mule, though it is doubtful whether they are indigenous to India. Records of Oestrids infesting man in other parts of the world are briefly reviewed.

AUSTEN (E. E.). **On a new Dipterous Parasite (Family Calliphoridae, Subfamily Calliphorinae) of the Indian Elephant, with Notes on other Dipterous Parasites of Elephants.**—*Proc. Zool. Soc. Lond.*, 1930, pt. 3, pp. 677–688, 3 figs. London, October 1930.

The Calliphorid, *Elephantoloemus indicus*, gen. et sp. n., both sexes of which are described, was bred from larvae that emerged from the skin of an Indian elephant in Burma. Notes are given on the other known Dipterous parasites of elephants, *viz.*, the Oestrids, *Cobboldia elephantis*, Steel, *C. loxodontis*, Br., *Rodhainomyia chrysidiformis*, Rodh. & Beq., *Neocuterebra squamosa*, Grünb., *Pharyngobolus africanus*, Br., and the Tachinid, *Ruttenia loxodontis*, Rodh., of which all except *C. elephantis* attack the African elephant.

TETLEY (J. H.). **Cage for the Study of Sheep Ticks.**—*Nature*, cxxvi, no. 3186, p. 809. London, 22nd November 1930.

A muslin cage that is sewn to the skin of the sheep for the study of *Melophagus ovinus*, L. (sheep ked) under as normal environmental conditions as possible is described. The short edges of a rectangular piece of muslin, 12 by 8 ins., are sewn together, and on one end of the cylinder, thus formed, the selvage is retained so as to afford a suitable hold for the sterilised horsehair with which it is attached to the sheep. The wool is clipped away in the form of a circular track 2 ins. wide, leaving a clump of wool about 3 ins. in diameter in the centre; over this the cylinder of muslin is fitted and hemmed to the skin by a double thread of hair. The cage is closed by drawing the outer edge of the cylinder, bag fashion, and tying with tape, and for the examination of keds can be rolled back like a stocking. It was found that the attachment of such a cage in the region of the hind ribs, half-way down the side, ensured its being covered and protected by the fleece and provided conditions favourable to *Melophagus*.

ALDRICH (J. M.). **Notes on the Types of American two-winged Flies of the Genus *Sarcophaga* and a few related Forms described by the early Authors.**—*Proc. U.S. Nat. Mus.*, lxxviii, art. 12, no. 2855, 39 pp., 3 pls. Washington, D.C., 1930.

This paper gives the results of an investigation of the identity of American species of *Sarcophaga* described by early authors, based on a study of the types. The species dealt with include *S. tessellata*, F. (*aurifinis*, Wlk.), *S. haemorrhoidalis*, Mg. (*georgina*, Wied.), *S. stimulans*, Wlk. (*quadrisetosa*, Coq.), *S. rapax*, Wlk. (*helicis*, Towns.), *S. lherminieri*, R.-D. (*pallinervis*, Thoms., *communis*, Parker), *S. barbata*, Thoms. (*falculata*, Pand.), *S. setulosa*, Wulp (*cimbicis*, Towns.), *S. pusiola*, Wulp (*peniculata*, Parker), and *S. sueta*, Wulp (*communis* var. *ochracea*, Aldr.).

MacDougall (R. S.). **The Warble Flies of Cattle.**—*Trans. Highl. Agric. Soc. Scotland*, 1930, reprint 40 pp., 23 figs., refs. Edinburgh, 1930.

This account of the bionomics and control of *Hypoderma bovis*, DeG., and *H. lineatum*, Vill., in the British Isles is compiled from the literature and from the author's own observations [*cf. R.A.E.*, B, xvi, 255 ; xv, 8 ; xiv, 163 ; etc.]. In numerous experiments larvae were broken in the backs of cattle, but in no case was "rose fever" induced [*cf.* viii, 82]. As regards anaphylaxis in cattle [*cf.* vi, 44], extracts of *Hypoderma* larvae were injected into calves and although reactions were immediately observed, the symptoms were only temporary, and the animals recovered in all cases.

Neiva (C.). **Contribuição á biologia de** *Oestrus ovis*.—*Rev. Indust. animal*, i, no. 6, pp. 628–639, 6 figs., 1 pl., 23 refs. S. Paulo, September 1930.

A brief review is given of the literature on the biology of *Oestrus ovis*, L., and laboratory observations made in Brazil are discussed. It was found that pupal development could occur either on the surface of the ground or at depths of 2–4 inches in dry or moist earth.

Bacigalupo (J.). **El** *Dermestes peruvianus* **Castelnau en la transmisión del** *Hymenolepis diminuta* **(Rudolphi).**—*Semana méd.*, xxxvi, no. 34 (1858), pp. 559–560, 2 figs. Buenos Aires, 22nd August 1929. (Abstract in *Trop. Dis. Bull.*, xxvii, no. 12, p. 966. London, December 1930.)

Dermestes peruvianus, Cast., a new intermediate host of *Hymenolepis diminuta*, has been found infected in its larval stage both naturally and experimentally. The adult has not been found infected.

[Blagoveshchenskiĭ (D. I.).] **Благовещенский (Д. И.). Notes on Arthropod Parasites of domestic Animals in the Leningrad Region.** [*In Russian.*]—*Plant Protection*, vi, no. 5–6, pp. 663–667, 15 refs. Leningrad, 1930.

The economic importance of the study and control of parasites of cattle and other domestic animals is discussed, and a list is given of the blood-sucking Diptera attacking, and the Arthropods parasitic on, domestic animals and poultry observed in the Leningrad and Novgorod Governments in the years 1927–29. The Arthropods are arranged under their hosts, and brief notes on the abundance and biology of some of them are given.

[Rukavishnikov (B. I.).] **Рукавишников (Б. И.). Essays of Avio-control of** *Anopheles maculipennis* **Mg.** [*In Russian.*]—*Plant Protection*, vi, no. 5–6, pp. 775–776. Leningrad, 1930.

In continuation of experiments with Paris green against larvae of *Anopheles maculipennis*, Mg. [*R.A.E.*, B, xvii, 201, etc.], tests with dusting by means of aeroplanes were carried out in September 1929 near Moscow, Paris green containing about 55 per cent. of As_2O_3 being mixed with talc in proportions of 1:5 and 1:20. Small dishes of water containing larvae of *A. maculipennis* and *Culex pipiens*, L., were placed at

intervals on a line of 110 yds. long, at right angles to the line of the flight. The aeroplane flew at a height of 23 ft., and the effective strip of dust was 110–137 yds. wide. The application of the stronger mixture at the rate of 4¾ lb. per second (equivalent to nearly 1 lb. of pure Paris green to the acre) killed all the larvae of *A. maculipennis* in 12–15 hours and all those of *C. pipiens* in 24. The weaker mixture applied at the rate of 2½ lb. per second (equivalent to 2·2 oz. of pure Paris green to the acre) killed all the Anopheline larvae and 22 per cent. of those of *C. pipiens* in 24 hours, and 34 per cent. of the latter in 5 days.

The advantage of using a mixture of Paris green and talc instead of sodium arsenite or calcium arsenite is pointed out, as the width of the effective strip of dust produced by the latter substances is only half that obtained with the former, while the amount of these poisons used to an acre is about 3½–4½ lb., as compared with a few ounces in the case of Paris green. The value of the use of aeroplanes in the control of mosquito larvae is briefly discussed.

PICARD (W. K.). **In Ned.-Indië voorkomende Pluimveeziekten.** [Poultry Diseases in the Dutch East Indies.]—*Ned.-Ind. Bl. Diergeneesk.*, xli, no. 1, pp. 42–48. Batavia, 1929. (With Summaries in German and English.) [Recd. October 1930.]

The eye worm of fowls in the Dutch East Indies is *Oxyspirura mansoni*. As other workers have shown that *Pycnoscelus surinamensis*, L., is the intermediate host of *O. mansoni* and *O. parvovum* [*R.A.E.*, B, xv, 77; xvi, 102, 132], an investigation is being conducted at Buitenzorg to ascertain the part played by cockroaches in the Dutch East Indies.

KRIJGSMAN (B. J.). **De gastheerkeuze van bloedzuigende Arthropoden. Deel I.** *Stomoxys calcitrans.* [The Choice of Host by Blood-sucking Arthropods. Part I. *S. calcitrans.*]—*Ned.-Ind. Bl. Diergeneesk.*, xlii, no. 1, pp. 56–72, 14 refs. Batavia, 1930. (With Summaries in Dutch, German and English.)

KRIJGSMAN (B. J.) & WINDRED (G. L.). **Deel II.** *Lyperosia exigua.* [Part II. *L. exigua.*]—*T.c.*, no. 2, pp. 110–120, 7 refs. (With Summaries in Dutch, German and English.)

Field and laboratory experiments on the tropisms of *Stomoxys calcitrans*, L., and *Lyperosia exigua*, de Meij., the technique of which is described, indicated that the skin odour of the host is the chief stimulus that induces feeding and also enables the flies to differentiate between one species of mammal and another.

NIESCHULZ (O.) & KRANEVELD (F. C.). **Over de prophylactische waarde van Naganol bij Paarden-Surra. (II. Mededeeling.)** [On the prophylactic Value of Naganol in equine Surra. (2nd Communication.)]—*Ned.-Ind. Bl. Diergeneesk.*, xlii, no. 4, pp. 381–389. Batavia, 1930. (With Summaries in German and English.)

In experiments in Java, injections of 2 gm. Naganol per 150 kgm. of body-weight protected horses against infection with surra even when repeatedly bitten by numbers of *Tabanus rubidus*, Wied., and *T. striatus*, F., that had fed on an infected animal.

Helminthological Society of Washington.—*J. Parasit.*, xvii, no. 1, pp. 52–58. Urbana, Ill., September 1930.

In the course of the proceedings, M. F. Jones presented a preliminary note on the life-history of *Metroliasthes lucida*, a tapeworm of the turkey. Gravid segments of this worm were fed to *Melanoplus differentialis*, Thomas, and another grasshopper of the same genus. In eight grasshoppers cysticercoids of various ages were recovered, the numbers found varying from 1 to 20. Cysts, apparently mature, were fed to two fowls and one quail, but no tapeworms were found on post-mortem examination.

She also reported that *Calathus opaculus*, Lec., was an additional intermediate host for the poultry cestode, *Raillietina cesticillus*. After 28 days one of these Carabids fed on gravid segments was found to contain fully developed cysticercoids. The material was fed to a fowl, and after 26 days gravid segments of *R. cesticillus* were passed in its droppings.

W. A. Hoffman has recently found *Heterodoxus longitarsus*, Piaget (dog-kangaroo louse) in large numbers on dogs in Porto Rico. Presumably for centuries this louse has lived on kangaroos in Australia, but following the importation of these marsupials into other countries it has become an important parasite of dogs, and now occurs on them over much of temperate and tropical America.

Spencer (G. J.). **Insect Pests (or Insect Allies) that have recently arrived in Vancouver District, British Columbia, 1928-1929.**—*60th Ann. Rep. Ent. Soc. Ontario 1929*, pp. 82–84. Toronto [? 1930].

Arthropods probably recorded for the first time in the Vancouver district in 1928–29 include *Liponyssus bursa*, Berl. (tropical fowl mite), which appeared in the spring, seriously injuring poultry, and *Dermanyssus gallinae*, DeG., which was found infesting canaries. *D. gallinae* occurs rather widely and has probably been present for a considerable period.

Miller (F. W.). **Mosquito Control in New Jersey.**—*60th Ann. Rep. Ent. Soc. Ontario 1929*, pp. 89–92. Toronto [? 1930].

The progress of anti-mosquito measures in New Jersey during the present century is briefly outlined. In the discussion that followed the author stated that from £75,000 to £80,000 was spent annually on mosquito control. Oiling is now carried out by means of large tanks and small pressure pumps mounted on trucks, with which it is possible to spray for a distance of 35 ft. The oil used is specially prepared and treated with acid, and costs about 4*d.* a gallon, 1 U.S. pt. of oil covering about 33 sq. ft.

Twinn (C. R.). **Some Observations and Remarks on Mosquito Control.**—*60th Ann. Rep. Ent. Soc. Ontario 1929*, pp. 92–96, 2 refs. Toronto [? 1930].

The organisation of mosquito control measures in Canada is discussed from the point of view of finance, personnel, equipment and oils [*cf. R.A.E.*, B, xvii, 243].

MARTINI (E.). **Culicidae.**—In LINDNER *Flieg. Palaearkt. Reg.*, xi & xii, pp. 1–320, 360 figs., 1 pl. Stuttgart, E. Schweizerbart, 1929–30.

The author deals with the Anophelines in pp. 116–193 of this work, which has not yet been completed. He considers *Anopheles relictus*, Shing. [cf. *R.A.E.*, B, xvi, 200 ; xviii, 95] to be a variety of *A. elutus*, Edw., and describes another variety, *elutior*, n., from Turkestan. He does not agree with Edwards in adopting the name *sacharovi*, Favr, for *elutus* as it is uncertain to which of these forms the name would apply. *A. amaurus*, sp. n., and *A. chodukini*, sp. n., are described from Turkestan, and *A. hyrcanus* var. *mahmuti*, n., from Asia Minor.

ROUBAUD (E.). **Sur l'existence de races biologiques génétiquement distinctes chez le moustique commun,** *Culex pipiens*.—*C.R. Acad. Sci. Fr.*, cxci, no. 25, pp. 1386–1388, 1 ref. Paris, 1930.

Biological data are given on the normal and autogenous strains of *Culex pipiens*, L. [*R.A.E.*, B, xvii, 108 ; xviii, 169]. In the case of the former race, for which rest at a low temperature is essential, after three active generations there supervenes an inactive or hibernating one, which cannot be reactivated by heat. The mosquitos of this strain live out of doors and cannot oviposit without a blood meal. The autogenous race lives entirely in towns and breeds continuously, even in winter, in artificially heated places, and although the adults readily bite man and animals, they can lay fertile eggs without a feed of blood [*cf.* also, xviii, 94]. The two races have been found to breed true and to be genetically distinct, the autogenous character being recessive.

KRYGER (J. P.). **Notes on our Mosquitos.** [*In Danish.*]—*Flora og Fauna*, no. 2, pp. 53–57. Copenhagen, 1930.

The only mosquitos occurring in dwellings and stables in the neighbourhood of Copenhagen are *Anopheles maculipennis*, Mg., *Culex pipiens*, L., and *Theobaldia annulata*, Schr. Some details are given of the numbers of each observed by the author in rooms and cellars at various times of the year.

KAMAN (M.). **Verbreitung und Biologie der** *Anopheles maculipennis*-**Art im Malariagebiet der Mur und Drau (Bezirk Prelog und Ludbreg).** [Distribution and Biology of *A. maculipennis* in the Malaria Region of the Mur and Drava (District of Prelog and Ludbreg). (*In Serbian.*)]—*Glasnik hrv. prirodosl. Dr.*, xxxix-xl, pp. 176–191, 6 figs. Zagreb, 1928. (With a Summary in German.)

Investigations in 1927–28 in the malarious region of the Mur and Drava (in Hungary and Jugoslavia) showed that ideal conditions for the breeding of *Anopheles maculipennis*, Mg., are provided by the overgrown irrigation ditches and disused clay and lime pits. This mosquito also bred in the partly dried-up beds of streams, in swamps, and in ponds with dense vegetation on their banks. No adults were found in dwellings, but they were very numerous in cattle sheds and stables. The hibernation quarters could not be found, though a few adults were seen in cellars with large numbers of *Culex pipiens*, L.

Drainage of the swamps and other breeding-places and filling in of the pits are recommended. The possibilities of the introduction of *Gambusia*, unsuccessfully attempted in 1926, are discussed.

[SHIPITZINA (N. K.).] **Шипицина (Н. К.). On the Rôle of the organic Colloids of Water in the Feeding of the Larva of** *Anopheles maculipennis*. [*In Russian.*]—*Bull. Inst. Rech. biol. Univ. Perm*, vii, pt. 4, pp. 171–194, 4 figs., 18 refs. Perm, 1930. (With a Summary in English.)

An account is given of preliminary laboratory experiments carried out in Perm in 1928 and 1929, the object of which was to establish the minimum size of particles that may be caught by the mouth brushes of larvae of *Anopheles maculipennis*, Mg., to find whether they can develop on minute organic particles filtered from water, chiefly colloids, and to determine the filtration capacity of the larvae in a unit of time. Feeding the larvae of the first four instars on solutions of Chinese ink, containing particles from 1μ to $0{\cdot}1\mu$, carmine, and a medical preparation of colloidal silver, the diameter of the particles of which is $20\mu\mu$, indicated that the filtering apparatus of the larvae is capable of catching colloidal particles, as the concentration of the substances tested was much greater in their guts than in the water. They were, however, unable to filter particles of soluble starch, the diameter of which was $5\mu\mu$.

To determine whether the larvae are capable of growing on colloidal substances of natural waters, they were reared on the water from a small pond, as being their optimum habitat, the same water filtered, and artificial fresh water. The contents of food organisms of these media are discussed. The larvae lived for from 6 to 40 days, but their development was retarded, and in none of the cultures did they reach the fourth instar, deficiency of food being evidently the factor concerned. Their growth was more retarded in water passed through a paper filter than in the unfiltered pond water, showing that the coarser particles in suspension are important as food; it was, however, more rapid even in water percolated through a bacterial filter than in the artificial fresh water, which indicates that water colloids play a definite part in feeding them.

The chemical method used to determine the amount of water filtered by a larva in a unit of time is described. A fourth-instar larva in pond water at a temperature of 17·5–21·25° C. [63·5–70° F.] filtered about 100 cu. mm. of water a day.

The author inclines to the view that although the larvae may live on the colloid fractions of the organic substances occurring in water, the latter alone are not sufficient for their normal development, and that they feed on all particles in suspension, an important part being played by the coarse ones.

[KOTLYAREVSKAYA (E.).] **Котляревская (Е.). Sur les causes de la mort des larves d'***Anopheles maculipennis* **dans l'eau de tourbière.** [*In Russian.*]—*Bull. Inst. Rech. biol. Univ. Perm*, vii, pt. 4, pp. 195–220, 19 refs. Perm, 1930. (With a Summary in French.)

A detailed account is given of laboratory experiments carried out near Perm in the summer of 1929, which confirmed the results obtained

by Beklemishev and Mitrofanova [*R.A.E.*, B, xvii, 3, etc.]. It was found that *Sphagnum* peat-bog water was completely unsuitable for the larvae of *Anopheles maculipennis*, Mg., the factors responsible being lack of sufficient and favourable food, low pH, and the essentially destructive action of the water owing to its chemical composition. No eggs or larvae were ever found in nature in peat-bog water in which the larvae could not mature, this fact confirming the assumption that females do not oviposit in unsuitable breeding-places [xiv, 131].

[Kalandadze (L.) & Mchelidze (I.).] **Каландадзе (Л.) и Мчелидзе (И.). Data on the Biology of** *Gambusia affinis*. [*In Georgian.*] —*Nachr. trop. Med.*, iii, no. 1, pp. 23–40, 3 refs. Tiflis, May–June 1930. (With Summaries in Russian and German, pp. 88 & 96.)

Observations were carried out in and near Batum on the biology of *Gambusia affinis*, which, since its introduction into Abkhasia in 1924, has greatly increased in numbers and now plays an important part in the control of mosquitos. It was found that the fish could survive under very unfavourable conditions ; they thrived in highly polluted water that was hardly deep enough to cover them, and developed normally in water rich in tannin. The presence of any iron oxide in the water, however, was fatal to them, and when placed in sea water they died within a week [but *cf. R.A.E.*, B, xvi, 143, 149]. The young fish could subsist entirely on the micro-organisms that occurred in water containing vegetation. Other small fish were readily attacked by *Gambusia* even when mosquito larvae were available. Each female produced 50–100 completely developed young at a time, but under artificial conditions these were invariably devoured by the adult fish. In an experiment the young were dissected from the females and released in a separate reservoir, where they thrived normally ; this method is, therefore, recommended for breeding *G. affinis* under artificial conditions. In nature the young fish avoid being eaten by hiding among dense vegetation, or by remaining in very shallow water. They feed on mosquito larvae of the first and second instars and on various micro-organisms. The adults showed a definite preference for the larvae of *Culex*, especially in reservoirs with abundant vegetation, and the eggs of *Anopheles*, and also fed on pupae. One individual may devour 300 or more larvae in 5 minutes. At temperatures below 10° C. [50° F.] the fish hibernate in the mud [*cf.* xvi, 149].

Oiling was fatal to *Gambusia* only when applied in very shallow water devoid of vegetation, but most of the fish were killed by the usual applications of Paris green.

Orlowa (A. A.) & [Shakhov] Schachow (S. D.). **Culicidae und Phlebotominae des Bezirkes Kaarry-Kala in Turkmenien.** [Mosquitos and Sandflies of the Kara-kala District of Turkmenistan.]—*Arch. Schiffs- u. Tropenhyg.*, xxxiv, no. 11, pp. 593–608, 12 figs., 28 refs. Leipzig, November 1930.

Notes are given on mosquitos and sandflies collected from May to September 1929 in the Kara-kala district of Turkmenistan. *Anopheles plumbeus*, Steph., not previously recorded from the country, was found

in tree-holes, and *A. maculipennis*, Mg., and *A. sacharovi*, Favr (*elutus*, Edw.) in marshes. *A. sacharovi* is more widely distributed than *A. maculipennis*; its larvae are sometimes found in stagnant water, but usually occur in running water in irrigation systems, rivers, and springs. *A. superpictus*, Grassi, and *A. bifurcatus*, L., also occur in the springs, the latter being found in the coldest part (the outflow), whereas *A. superpictus* occurs in the centre, which is warmed by the sun and is usually full of *Spirogyra*. The females of the latter species abound in stables, store-rooms, etc., but are rare in living rooms, or in the Turcoman felt tents. In the Tschendyr valley, where such tents are the only habitations, the female mosquitos pass the day in the caves dug for storing fodder. *A. bifurcatus* attacks man severely at night, but rarely by day. It is the first of the Anophelines to appear in spring. From May onwards *A. sacharovi* begins to predominate until in summer it is displaced by *A. superpictus*.

The sandflies collected were *Phlebotomus papatasii*, Scop., *P. sergenti*, Parrot, *P. caucasicus*, Marz. (*li*, Popov), *P. sergenti* var. *alexandri*, Sinton, *P. chinensis*, Newst. (*major* var. *longiductus*, Parrot), *P. perniciosus*, Newst., *P. minutus*, Rond., and *P. minutus* var. *sogdianus*, Parrot. Almost all these species were found in the caves for storing fodder, some being very abundant. *P. sergenti* and *P. papatasii* also occur in dwellings and animal quarters, and the latter was taken twice in a gorge about twelve miles from the nearest dwelling, and also, together with *P. sergenti* var. *alexandri*, in shallow clefts in hills. *P. chinensis* was found in Tschendyr only. The ductus ejaculatorius in this species showed great variation and is considered quite unreliable for the purpose of identification.

Scott (G. W.). **Report on Malaria Prevention Work carried out at Chenderoh.**—*Malayan Med. J.*, v, no. 3, pp. 86–89, 8 pls. Singapore, September 1930.

An account is given of successful malaria prevention work carried out during the years 1927-29, in connection with a camp for housing the labourers engaged in the construction of a dam across the Perak River, Malaya. The only malaria vector was *Anopheles maculatus*, Theo. The usual anti-larval measures, such as clearing, oiling and draining, were carried out, but no screening, quinine prophylaxis, or other supplementary measures were used.

Borel (E.). **Les moustiques de la Cochinchine et du Sud-Annam.**—*Coll. Soc. Path. exot. Monog.*, iii, 423 pp., 3 pls., 122 figs. Paris, Masson & Cie, 1930. Price *Fr.*70.

This work, which is a publication of the Instituts Pasteur d'Indochine, is divided into three parts. The first contains a description of the geography and climate of Cochin China, and the second, which comprises the bulk of the paper, deals with the classification of the mosquitos found in Cochin China and South Annam, giving keys for the identification of genera and species. The species are described, including some that are apparently new but are not named. Some of the more important chapters in this section have already been noticed

from another source [*R.A.E.*, B, xvi, 250 ; xvii, 116, 253]. In the third part, the author discusses the relation of mosquitos to malaria, dengue and filariasis.

KAISER (L.). **Het intermitteerend moeras van Rangas.** [The intermittent Swamp at Rangas.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxx, no. 7, pp. 692–694, 1 pl. Weltevreden, 1st July 1930.

At Rangas, a village on the coast of western Celebes, swamps are formed at high tide owing to the presence of subterranean channels, the water disappearing again when the tide ebbs. *Anopheles subpictus*, Grassi (*Myzomyia rossi*, Giles), *Culex sitiens*, Wied., and *Aëdes vigilax*, Skuse, the adults of which occur in dwellings, were bred from larvae found in these swamps, and it is concluded that the larvae and pupae can live in the spongy ground and resume development when the water flows in, a fact not previously observed with *Anopheles* [see next abstract]. The water has a salt content of about 2 per cent. After shutting off communication with the sea, the ground was raised by dumping stones to a level above high water.

BONNE (C.). **Voortleven van Anopheleslarven in vochtige aarde.** [The Survival of *Anopheles* Larvae in moist Earth.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxx, no. 8, p. 804. Weltevreden, 1st August 1930.

Referring to the preceding paper, the author states that in a report on a journey to the Panama Canal Zone in 1916, he pointed out that larvae of both Anophelines and Culicines can live for some time in moist earth.

DE ROOK (H.). **Filariasis onder de Papoea's aan den Boven-Digoel.** [Filariasis among the Natives on the Upper Digoel River, Dutch New Guinea.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxx, no. 8, pp. 739–745, 2 pls., 3 refs. Weltevreden, 1st August 1930.

Filariasis is common on the Upper Digoel river, Dutch New Guinea. It is caused by *Filaria* (*Microfilaria*) *bancrofti*, which was found to have a night periodicity. One case of infection by *F.* (*M.*) *malayi* was found in this district in a native of western Celebes ; its night periodicity was much less marked. *Culex fatigans*, Wied., which appears to have been imported into the port of Tanah-Merah in 1929, was not found on the Upper Digoel, nor does *Aëdes variegatus*, Dolesch., occur there. The latter is a vector of *F. bancrofti* in Fiji, where the microfilariae have a day periodicity.

SHANNON (R. C.) & DAVIS (N. C.). **Observations on the Anophelini (Culicidae) of Bahia, Brazil.**—*Ann. Ent. Soc. Amer.*, xxiii, no. 3, pp. 467–505, 7 pls., 25 refs. Columbus, Ohio, September 1930.

The following is taken from the authors' summary : Twelve species of the ANOPHELINI are now known from the State of Bahia, ten of which are here recorded from the capital (São Salvador or Bahia) and

the immediate environs. Three additional species are listed that may eventually be found in the locality. The larvae, pupae and males of *Anopheles* (*Stethomyia*) *nimbus*, Theo., *A. minor*, Costa Lima, and a third species, which is here recorded tentatively as *A.* (*Manguinhosia*) *peryassui*, D. & K. (*Manguinhosia* being regarded as a group of the subgenus *Anopheles*), have hitherto been more or less unknown; the larvae, pupae, and adults of both sexes are therefore described in detail.

A. nimbus differs so strikingly from the other known Anophelines in the structure of the phallosome and other male and larval characteristics, that *Stethomyia* is here accorded generic rank [*cf.* *R.A.E.*, B, xix, 12]. It is shown that it is not closely allied to the other American Anophelines but apparently possesses rather close relations with certain Australian and Malayan species; it possibly represents, therefore, an isolated form of a group that had its centre of distribution in a former Antarctic continent.

CARR (R. H.). **Pond Water Composition and Mosquitoes.**—*Proc. Indiana Acad. Sci.*, xxxix, pp. 157–158, 3 refs. Indianapolis, Ind., 1930.

It was observed by the author in Ohio that no mosquitos bred in a pond containing a spring, although they occurred in a stream close by. The water of the stream was rather soft, while that of the pond was very hard, analysis showing a total hardness of 410 and an alkalinity of 347. The absence of mosquitos from the pond was all the more remarkable in that a green alga was growing very luxuriantly in it, while there was none in the stream.

PHILIP (C. B.). **Supplemental Note regarding Mosquito Vectors of experimental Yellow Fever.**—*Science*, lxxii, no. 1875, pp. 578–579, 3 refs. New York, N.Y., 5th December 1930.

This paper is supplementary to a review of work on mosquitos that are experimental vectors of yellow fever [*R.A.E.*, B, xviii, 198] and includes references to the transmission of the disease by *Aëdes albopictus*, Skuse, in experiments by Dingler and his co-workers [*cf.* xviii, 82]. In one experiment a fatal infection in *Macacus rhesus* was produced by the bite of one of these mosquitos.

RICHARDSON (C. H.) & SHEPARD (H. H.). **The Effect of Hydrogen-ion Concentration on the Toxicity of Nicotine, Pyridine and Methylpyrrolidine to Mosquito Larvae.**—*J. Agric. Res.*, xli, no. 4, pp. 337–348, 3 figs., 25 refs. Washington, D.C., 15th August 1930.

The toxicity of nicotine to larvae of *Culex pipiens*, L., was studied in aqueous solutions at various pH values. A few similar experiments were also made with pyridine and methylpyrrolidine. The speed of toxic action of these substances to the larvae was directly related to the concentration of the undissociated molecules. It is believed that the toxicity results largely from the penetration of the molecules into the body through the wall of the alimentary tract. Nicotine ions are

somewhat toxic but much less so than nicotine molecules. It is also believed that the rise in toxicity of a nicotine solution with a rise in pH results largely from the dissociation of the pyrrolidine nitrogen.

Previous writers have explained the greater toxicity of nicotine over nicotine sulphate on the basis of the greater volatility of the former. In this study it is shown that the free base in solution is also much more toxic than nicotine sulphate.

LAN-CHOU (F.). **Experiments with** *Dirofilaria immitis* **and local Species of Mosquitos in Peiping, North China, with a Note on** *Lankesteria culicis* **found in** *Aëdes koreicus*.—*Ann. Trop. Med. Parasit.*, xxiv, no. 3, pp. 347–366, 2 pls., 9 refs. Liverpool, 22nd October 1930.

Dogs in north China are frequently infected with *Filaria* (*Dirofilaria*) *immitis*, and in 1929 experiments were undertaken with bred mosquitos fed on an infected dog in order to determine which species are the vectors. Dissections of 187 individuals of *Aëdes koreicus*, Edw., showed that 55 per cent. were infected. Of the 27 dissected between the tenth and fifteenth day after feeding, all but four were positive, and it is concluded that if the mosquitos had lived as long as they probably would have under natural conditions, a higher percentage would have given positive results. Of 114 individuals of *Anopheles hyrcanus* var. *sinensis*, Wied., 68 per cent. were positive, and 37 of the 53 dissected after the tenth day were positive.

In both species the microfilariae pass into the malpighian tubes within 1–24 hours after feeding. At 25–28° C. [77–82·4° F.], the whole development is completed in 10–15 days, and the parasites pass forward to the labium. The mature larvae have been seen proceeding to the legs, in the head above the pharynx, and sometimes even in the palpi. At different stages of development, dead and calcified larvae were observed in *Aëdes koreicus*, but not in *Anopheles hyrcanus* var. *sinensis*. Dogs in China usually live out of doors, and as these two species of mosquitos seldom enter houses, they are equally likely to transmit the disease.

The other two common species of mosquitos in the vicinity of Peiping are *Anopheles* (*Myzomyia*) *pattoni*, Christophers, and *Culex pipiens*, L. Of 80 individuals of *A. pattoni* fed on the infected dog, only three killed immediately after feeding contained parasites, and it seems evident that this mosquito is not a suitable host. It was exceedingly difficult to make *C. pipiens*, the common house mosquito, feed on the dog, less than 1 per cent. actually biting. Out of 31 mosquitos dissected, degenerating microfilariae were found in the stomach of one individual one day after feeding.

A. hyrcanus var. *sinensis* is widely distributed throughout China, whereas *Aëdes koreicus* is confined to Korea and North China. It is possible that other species of *Aëdes* in other parts of China may be equally important vectors.

In the course of dissections of *A. koreicus*, oocysts of *Lankesteria culicis* were encountered in several cases. Of 25 larvae and 16 pupae of this mosquito bred in the laboratory, all showed gregarines in the mid-gut, and some of the pupae also showed oocysts in the malpighian tubes. Larvae of *Culex pipiens* from the same source all proved negative. Of the larvae and pupae of *A. koreicus* collected in the field only a few were infected. This seems to be due to the fact

that when mosquitos emerge and are left in a cage, they defaecate and mature oocysts pass into the pan and infect all the larvae, whereas in nature only certain of the breeding-places are infected. The distribution of the various forms of *L. culicis* in the different stages of the mosquito is discussed.

TAYLOR (A. W.). **The domestic Mosquitos of Gadau, Northern Nigeria, and their Relation to Malaria and Filariasis.**—*Ann. Trop. Med. Parasit.*, xxiv, no. 3, pp. 425–435, 1 graph, 5 refs. Liverpool, 22nd October 1930.

Regular examination and dissection of domestic mosquitos was undertaken at Gadau, Northern Nigeria, from June to October 1929 and from January to March 1930, inclusive. In this locality the climate is dry with a low rainfall, all of which occurs between the beginning of May and the end of October. In general mosquitos are only numerous from July to November. *Anopheles gambiae*, Giles (*costalis*, Theo.) and *A. funestus*, Giles, are the most prevalent species and together constitute 91·4 per cent. of the domestic Anophelines. Culicines are very scarce and only make up 3·4 per cent. of all domestic mosquitos.

Dissections of 3,563 Anophelines and 117 Culicines taken in European and native dwellings were carried out, and analyses of the malarial and filarial infection rates are given. These rates are approximately equal in the collections from the European and African sections of the Station. Developmental forms of *Plasmodium* were found only in *A. gambiae* and *A. funestus*, dissections of 205 individuals of *A. pharoensis*, Theo., 83 of *A. squamosus*, Theo., 46 of *A. mauritianus*, Grp., 24 of *A. rufipes*, Gough, and 9 of *A. nili*, Theo., giving negative results. Considerable fluctuations in the sporozoite rate of both species occurs during the rains and are evidently caused by the proportion in the catches of newly-emerged adults that have not had time to acquire infections. This proportion depends directly on the rate of breeding, which itself depends on the rainfall. The sporozoite infection rate of *A. gambiae* over the whole period of the dissections was more than double that of *A. funestus*.

Filariasis is extremely common among the natives of Northern Nigeria. *Filaria bancrofti* and *F.* (*Acanthocheilonema*) *perstans* are the species usually encountered, the former being most frequently seen in blood films. *F. perstans* has been shown in Kamerun to complete its development in *Culicoides austeni*, C., I. & M. [*R.A.E.*, B, xvi, 155], and attempts by several workers to infect various mosquitos with this Nematode have failed. Therefore, in the absence of evidence that other species of *Filaria* occur in this district, it is assumed that all filarial infections encountered in dissections were due to *F. bancrofti*.

Mature infections were found in *Anopheles gambiae* and *A. funestus*. Immature infections, in which only thoracic muscles are involved, were also seen in *A. pharoensis* (5 per cent.) and *A. squamosus* (1·2 per cent.). The total infection rate in *A. gambiae* was 8·6 per cent. with a proboscis (mature) infection rate of 1·65; in *A. funestus* the corresponding figures were 4 and 0·9. Mosquitos taken in European and native quarters were infected to approximately the same extent. A single specimen of *Aëdes ochraceus*, Theo., out of 15 dissected, was found to contain a mature infection. As this Culicine constituted

only 0·4 per cent. of the total number of domestic mosquitos, it cannot be considered an important vector of *Filaria* in the district. On the other hand, *Anopheles gambiae* and *A. funestus* are evidently efficient carriers, and in view of their prevalence may be regarded as the principal vectors of this *Filaria* in the Northern Provinces of Nigeria.

Schilling (C.) & Schreck (H.). **The Influence of Passage through the invertebrate Host on the biological Characters of parasitic Protozoa.**—*Ann. Trop. Med. Parasit.*, xxiv, no. 3, pp. 437–442. Liverpool, 22nd October 1930.

During an expedition to German East Africa in 1912–14, the authors carried out experiments with *Glossina morsitans*, Westw., and different strains of *Trypanosoma brucei* to determine the effect on a relapse-strain of the parasite (one that has lost its reactivity to serum antibodies in the course of chronic infections) of passage through the insect that transmits the disease in nature. The flies were caught on the mainland and transported to a coral island where neither tsetse-flies nor indigenous vertebrates existed. Adults reared from pupae laid by these flies were used in the experiments, which are described in detail.

The results showed that passage through the fly caused an old relapse-strain to resume the characteristics of a primary strain. It seems possible that in this process of restoration, the sexual phase through which the parasite passes in the fly may play an important part. This question is of considerable practical importance, for if an insect vector were to transmit a relapse-strain unchanged, it would be necessary to immunise against innumerable relapse-strains of a parasitic species, a procedure that would be practically impossible. On the other hand, if a strain of *T. brucei* is homologous in a district, a view which these experiments support, immunisation against this uniform strain should be possible.

Hegh (E.). **La lutte contre les tsé-tsés. Recherches des gîtes à pupes et destruction des pupes qu'ils contiennent.**—7 pp. Brussels, Imprimerie industrielle et financière, 1930.

In this report, which was presented at the International Congress of Tropical Agriculture held at Antwerp in July 1930, the author suggests that experiments should be undertaken to test the value of searching out the breeding-places of tsetse-flies and periodically destroying the pupae contained in them, as a local measure for reducing their numbers to a negligible minimum. This measure would probably be most successful in the case of a species such as *Glossina palpalis*, R.-D., which has very definite requirements that limit its breeding grounds. The organisation of such an experiment is discussed in detail. Under certain circumstances one of three other methods might be equally effective: the natural or potential breeding-places may all be destroyed and the females forced to deposit pupae in unsuitable places, where the chances of their survival are small; the natural breeding-places may be destroyed and artificial breeding-places constructed, so that the pupae will be concentrated and may be regularly collected and destroyed; or natural or artificial breeding-

places may be used as traps by mixing with the soil some substance that will be toxic to the pupae without repelling the females, and by using an adhesive that will at the same time capture the adult flies.

Howard (L. O.). **A History of Applied Entomology (Somewhat Anecdotal).**—*Smithson. Misc. Coll.*, lxxxiv (Pub. 3065), viii+ 564 pp., 51 pls. Washington [D.C.], 29th November 1930.

In this work the author has collected a very large amount of data on the history of applied entomology throughout the world. He is greatly to be congratulated on the completion of this difficult task, though there is necessarily some inequality in the treatment of the many countries involved, owing to difficulties in obtaining information from those in which less attention is paid to the subject.

In the latter portion of the book a section is devoted to medical entomology and also to important modern developments, such as the use of predatory and parasitic insects in the biological control of insects and of weeds.

An interesting comparative table of the amount of publication by different countries is also given, and it is a source of gratification to the staff of the Imperial Institute of Entomology to find the distinguished author expressing the view that " possibly in publishing its very competent *Review*, it has done the greatest single service to applied entomology that can be thought of by the present writer."

Eliot (C. P.) & Ford (W. W.). **Further Observations on the Virus of Rat Anemia with special Reference to its Transmission by the Rat Louse,** *Polyplax spinulosa.*—*Amer. J. Hyg.*, x, no. 3, pp. 635–642, 22 refs. Baltimore, Md., 1st November 1929.

With regard to the transmission of the virus of rat anaemia by *Polyplax spinulosa*, Burm., experiments showed that certain colonies of bred rats free from ectoparasites are also free from the virus, and splenectomised individuals do not show *Bartonella muris* in the erythrocytes or develop anaemia. A splenectomised rat fed on the bodies of ten lice and kept under observation for three months showed no evidence of infection. On the other hand, when lice were removed from infected stock and placed on nine splenectomised rats, seven died of anaemia 18–20 days after infestation and 3–5 days after the first appearance of *Bartonella*; one rat recovered from a first attack but died of a relapse on the 33rd day after infestation ; and one rat recovered gradually and was alive after 3 months. The fact that lice engorged with heavily infected blood and lice engorged with blood from apparently normal animals of infected stock can both produce symptoms and death in the same length of time, indicates something more than the passive transfer of infected blood. *Bartonella muris* was found in the blood of 14 out of 62 wild rats examined, and 0·1 or 0·2 cc. of infected blood injected into young normal rats caused the appearance of *Bartonella* in the blood and a mild anaemia, apparently owing to the fact that the spleen of young animals has not fully developed the property inherent in the spleen of the normal adults that protects them from infection. The same amount of blood injected into a splenectomised rat induced a typical and fatal case of anaemia. Blood from wild rats showing no *Bartonella* produced no symptoms when injected in young rats.

Wegelin (C.). **Ueber die Dasselbeulenkrankheit (Hypodermiasis) des Menschen.** [Infestation of Man by *Hypoderma.*]—*Jahrb. St. Gall. naturw. Ges.*, lxv, pp. 214–226, 2 pls., 17 refs. St. Gallen, 1930.

Cases of infestation of man by *Hypoderma bovis*, DeG., and *H. lineatum*, Vill., are recorded from Switzerland.

Bishopp (F. C.), Laake (E. W.), Wells (R. W.) & Peters (H. S.). **Experiments with Insecticides against Cattle Grubs,** *Hypoderma* **spp.**—*J. Econ. Ent.*, xxiii, no. 5, pp. 852–863, 2 refs. Geneva, N.Y., October 1930.

Tests of single and repeated applications to the backs of cattle of various insecticides against *Hypoderma lineatum*, Vill., and *H. bovis*, DeG., are described. The experiments were conducted in New York, Texas and Vermont, under widely varying conditions, during the years 1925 to 1929, on dairy cattle kept mainly in the open except during milking hours. Special attention was given to the use of insecticides in dust form, the application of which was found to be simpler and attended by fewer disadvantages than that of either liquids or ointments. Excellent results were obtained with ground derris root and carriers containing derris extract. The greater efficiency of derris powders with a higher rotenone content clearly shows the insecticidal value of this material. Tobacco powders and dusts containing 2–3 per cent. free nicotine or nicotine sulphate were also extensively used and gave a high degree of control. Apparently there is little difference between the effectiveness of free nicotine and nicotine sulphate when these are used in hydrated lime, tripoli earth, kaolin or cream silica. Lime used alone, or even as a carrier, is objectionable because of the irritation caused to the throat of the operator and the caustic effect on the skin of the cattle. Tripoli earth is more satisfactory as a carrier than lime or kaolin, which has a tendency to form small pellets and does not penetrate the hair so well. Tests with tobacco powder containing 3·1 per cent. nicotine and with the same material reground indicate that fineness is an important factor, the reground powder giving a kill of 96·1 per cent., as against 61·4 per cent. with the other.

It is desirable to kill the larvae while so young that their effect on the host may be terminated as early as possible, but the toxicity of powders is somewhat lower in the case of the younger stages than in that of the older ones, probably because of the difficulty of getting the material through the small apertures and into the cysts. On this account and in view of the possibility that some of the larvae may be missed in making the applications, it is advisable to give treatments at intervals of 15 days, although 30-day intervals would seem to be adequate on the basis of the life-history.

Thoroughness of application and the quantity of insecticide used are important factors whatever the material or method employed. If the material is carefully worked into each hole, less is required to obtain the same result, but when the infestation is heavy, a general application is necessary, the insecticides being applied with a shaker can and lightly rubbed into the hair, in which case 2–3 oz. per head are required. In view of the possible danger to cattle, not more than 3 oz. of 2 per cent. or 2 oz. of 3 per cent. nicotine dust should be used on each animal. Derris products have no toxic effect on the cattle,

nor do they appear to exert any deleterious influence on the skin. The experiments indicate that such factors as the condition of the skin and the length of the hair, as well as climatic conditions, may influence the results obtained from insecticidal treatments. A heavy winter coat of hair holds the material over the larvae and appears to favour their destruction, provided that the insecticide is brought into close contact with the skin, though such a condition necessitates greater care in making the application. Although the effect of insecticides on larvae that cut holes through the skin subsequent to an application has not been fully determined, at least some of the materials tested have been fatal to those doing so several days after the insecticide had been applied.

Davidson (W. M.). **Rotenone as a Contact Insecticide.**—*J. Econ. Ent.*, xxiii, no. 5, pp. 868–874, 1 ref. Geneva, N.Y., October 1930.

Preliminary tests against insects of different types amenable to control by contact insecticides indicate that rotenone, a product extracted from derris root, has a high degree of toxicity [*R.A.E.*, A, xix, 101]. Among the results secured, rotenone in suspension, at concentrations of 1 : 1,150,000 and 1 : 2,300,000, killed 98–99 and 95 per cent. respectively of the larvae of Culicine mosquitos, and dusts containing 1–2 per cent. rotenone controlled *Menopon gallinae*, L. (*pallidum*, Nitz.) and *Eomenacanthus* (*M.*) *stramineus*, Nitz., on fowls. *Blattella germanica*, L., proved highly resistant to spraying with various aqueous suspensions, but 99 per cent. of these cockroaches were killed by 1 per cent. dust and 100 per cent. with 2 per cent. Some of the cockroaches placed in a cage 21 hours after it had been dusted were killed, indicating that they were poisoned by ingesting particles of rotenone.

Roe (R. J.). **Annual Report of the Veterinary Service for the Year 1929.**—*Ann. Rep. Dept. Agric. Cyprus 1929*, pp. 38–46. Nicosia, 1930.

A list of the parasites recorded from domestic animals in Cyprus is given and includes the following Arthropods : *Ixodes ricinus*, L., on goats, *Hyalomma aegyptium*, L., on dogs and sheep, *Haemaphysalis cinnabarina punctata*, C. & F., and *Rhipicephalus bursa*, C. & F., on sheep, *Argas persicus*, Oken, on poultry, *Columbicola* (*Esthiopterum*) *columbae*, L., on pigeons, *Gastrophilus intestinalis*, DeG., on horses, and an Oestrid, probably the same species, on mules, *G. nasalis*, L. (*veterinus*, Clark) on donkeys, *Hypoderma crossi*, Patton, on goats, *Oestrus ovis*, L., on goats and sheep, and unidentified species of *Hypoderma* on sheep and cattle.

Cowdry (E. V.) & Ham (A. W.). **The Life Cycle of the Parasite of East Coast Fever in Ticks transmitting the Disease. (Preliminary Note.)**—*Science*, lxxii, no. 1870, pp. 461–462. New York, N.Y., 31st October 1930.

Observations were made in Kenya on the life-cycle of *Theileria parva*, the causal organism of African Coast fever of cattle, in *Rhipicephalus appendiculatus*, Neum., the vector of the disease, in view of the fact that no successful study of the life-cycle of any piroplasm in the tissues of the transmitting tick has ever been made. Six batches

of ticks were used ; one lot were infected as larvae, one lot were fed on uninfected animals as larvae, three lots were infected in the nymphal stage and one lot were fed as nymphs on uninfected animals. The migration of the parasites from the red blood cells into the gut of the tick begins almost immediately. What appear to be male and female forms are distinguishable in the lumen of the gut. Many of the free forms are destroyed, but others penetrate the intestinal epithelial cells, where they appear about the sixth day, and increase in size about five times up to the 23rd day. From the day before the tick moults up to the 31st day, these intra-epithelial forms change into motile euglena-like forms, which penetrate the wall of the intestine and enter the body cavity. They make their way to the salivary glands, where they may be seen in contact with the cells. Over a period of several days after their formation the euglenoids in the nymphal series were observed to enter the salivary gland cells, where they were seen as early as the 25th, 23rd and 22nd days. The euglenoids then change rapidly into deeply staining spore-like structures, which increase in size to form mulberry-like masses. The peripheral swellings on these masses give rise to small forms of the parasite, which closely resemble those observed in infected animals. This form was the one usually seen in the salivary glands of the tick at the time of the next feed, which began on the 33rd, 36th, 35th and 29th days after engorgement. During the first four days of feeding, the small forms increase in number at the expense of the mulberry-like masses. Many of them are discharged into the lumina of the salivary acini, but many were still seen in ticks as late as the 12th day after attachment. The bites of ticks of the series containing these parasites in their salivary glands produced African Coast fever in susceptible animals, whereas the control ticks failed to do so.

Legg (J.) & Foran (J. L.). **Some Experiments on the Treatment of Tick-infested Cattle with Arsenical Dipping Fluids.**—*Proc. R. Soc. Queensland*, xli, no. 7, pp. 83–120, 11 refs. Brisbane, 12th February 1930.

Experiments and observations on the use of dips containing sodium arsenite in the treatment of cattle infested with the cattle tick [*Boophilus annulatus australis*, Fuller] in Queensland are described in detail. The authors consider that the results indicate the following conclusions, which differ in some respects from others previously noticed [*R.A.E.*, B, xvi, 194]. The tick is more resistant to treatment with arsenical dipping fluids during the last three or four days of parasitic adult life, and it is therefore of importance in any system of tick eradication that treatments should be so spaced as to prevent, so far as possible, any tick reaching the resistant stage. The application of these fluids prevents reinfestation for 24 hours but not for 48. If cattle are allowed to enter water immediately after dipping and remain there for considerable periods (as they frequently do in north Queensland during January–March, chiefly to avoid biting flies), the efficacy of the treatment is considerably reduced. Light showers do not interfere with treatment, provided that the animals have had time to dry. Retention of the animals in the vat, within reasonable limits, or increasing the length of the vat, does not influence the effect of the dipping fluid on the tick. Alteration in the physical character of the fluid, such as is brought about by prolonged use, does not interfere

with the efficacy of the solution. No two treatments with an arsenical dipping fluid containing up to 9 lb. arsenic (As_2O_3) to 400 gals. can be relied on to kill all ticks on an infested animal. The omission of the emulsion of tar and soap from the official Queensland dipping formula " A " [8 lb. arsenious oxide, 5 lb. caustic soda, $\frac{1}{2}$ lb. Stockholm tar, 4 lb. tallow or oil (animal or vegetable) and 400 gals. water] does not lessen the efficiency of the solution. Ticks may be protected from the dip by the long, dense hair that occurs on many cattle, particularly in the winter.

More work is required on the use of emulsions in dipping fluids. As the dipping fluid containing 6 lb. arsenic to 400 gals. was as effective under ordinary conditions as the standard fluid (8 lb.), it is not improbable that still higher dilutions could be used with equally good effects. More frequent use of dips of high dilution may prove more effective than a less frequent one of dips containing higher proportions of arsenic.

Legg (J.). **Some Observations on the Life History of the Cattle Tick** (*Boophilus australis*).—*Proc. R. Soc. Queensland*, xli, no. 8, pp. 121–132, 11 refs. Brisbane, 12th February 1930.

Boophilus annulatus australis, Fuller, which was introduced into Queensland from the Northern Territory about 1891, has now established itself wherever conditions are suitable for it, the line of demarcation between infested and non-infested areas being represented roughly by the watershed of the coastal rivers. Between these areas is a strip of country that is not infested in dry seasons but in wet seasons is liable to become so.

The preoviposition period, which extends from the time of repletion and detachment from the host until oviposition takes place, is usually passed beneath grass, leaves, etc., and lasts roughly 5–9 days in winter, 4–6 in spring and autumn, and 2–4 in summer. The length of the oviposition period also varies according to the season from 5 to 30 days. The average number of eggs laid by a female is 2,579. The incubation period varies from a minimum of 15 days (summer) to a maximum of 55 days (winter). Further south, or even at higher altitudes in the north, the maximum figure would probably be higher. The fertility of the egg masses is high ; 57 out of 127 selected indiscriminately showed a fertility of over 90 per cent., and the lowest percentage of fertility was 68. Experiments on the influence of immersion on the fertility of the eggs indicate that the flooding of pastures is not likely to have an important effect on them, and flooded streams may possibly assist in the distribution of the tick from one area to another. Direct sunlight has a very injurious effect, many batches of eggs being destroyed after an exposure of one hour, and although on cloudy days when the sun was largely obscured, some batches withstood 4 hours' exposure, the fertility was greatly reduced. This fact helps to explain why the tick has never been able definitely to establish itself on the open downs of northern and central Queensland or on the Barkly Tableland of the Northern Territory.

The young larvae are extremely active and under natural conditions crawl over the herbage and occasionally collect in masses together, particularly on the shady side of blades of grass, etc. In the laboratory, the maximum longevity of a larva was 154 days (approximately 5 months) and occurred among a batch that were shaded during the

whole period and supplied with plenty of moisture. In the open, on small isolated patches of grass, the maximum was 112 days. During a normal wet season, the ticks increase enormously owing to the abundance of moisture, the shade provided by the long grass and the excessive heat, which shortens the incubation period to a minimum. In cold dry winters conditions are reversed, and in a series of drought years the tick may disappear completely over extensive areas of country.

Twenty-four hours after being placed on cattle, the larval ticks had attached themselves, the most heavily infested areas being the flank, inguinal region and escutcheon, neck and brisket. There is a small areolar spot at the point of attachment, but practically no exudate from the skin. At the end of the 5th day engorgement is complete in many cases, and 2 days later most of the larvae have become nymphs. Apparently the nymph re-attaches itself almost immediately at or close to the original point of attachment. Engorgement of the nymph is rapid and is frequently completed by the 12th day ; 90 per cent. have moulted by the end of the 17th day. During the 24 hours following the attachment of the nymph considerable swelling appears on the surface of the body of the host. The swellings, which are probably due to the injection of a toxin, appear rapidly, remain for about 48 hours and disappear as rapidly. Their subsidence is followed in many cases by the appearance of a serous exudate round the point of attachment of the nymph, which may be completely hidden by it without apparently being inconvenienced. Necrosis of the skin frequently occurs, with the formation of a small ulcer ; infection easily follows, and where considerable numbers of nymphs are close together, the small ulcers may coalesce, and in this way a typical " tick-sore " is produced. From these observations it is concluded that the nymph is mainly responsible for the production of " tick-sore " and for the " lumpy " condition of the skin in naturally infested cattle. The adult female usually re-attaches itself at once at the same point or in close proximity to it. The adult males do not re-attach themselves, but wander in search of unfertilised females. The engorged females drop off between the 20th and the 35th day. There is evidence that adult females may be unable to reach a state of repletion if they are not fertilised. The total period of parasitism averages 22 days in summer and 24 in winter, the maximum period for a single tick being 35. All cattle, particularly those infested for the first time, display considerable resistance in the sense that only a small percentage of viable larvae placed on an animal ever reaches maturity, mortality occurring before attachment or soon after. Prolonged exposure to the tick rarely seems to increase resistance. Under ordinary circumstances *B. annulatus australis* seldom attaches itself to other hosts, but occasionally single horses become heavily infested with developing ticks, although others apparently exposed to an equal degree of infestation are only slightly infested. Sheep weakened by drought conditions are frequently heavily attacked. This tick has not been observed to develop on any native animal or bird.

BRUMPT (E.). **Transmission de la fièvre exanthématique de Marseille par la tique méridionale du chien** (*Rhipicephalus sanguineus*).—*C.R. Acad. Sci. Fr.*, cxci, no. 19, pp. 889–891. Paris, 1930.

By inducing Marseilles fever [*R.A.E.*, B, xviii, 189] in a healthy person by inoculation with crushed bodies of adults of *Rhipicephalus*

sanguineus, Latr., that had originated from a variety of habitats in Marseilles, the author showed that the infection is due to a virus definitely obtained by the tick from some mammal or bird, the most likely reservoir being the dog. Further research is, however, necessary before other domestic and wild animals can be excluded. In the inoculation carried out, fasting adults kept at laboratory temperature obtained from nymphs collected 56 days earlier were used, showing that the virus can pass from nymph to adult and preserve its pathogenic property even at a low temperature. *R. sanguineus* is probably the only tick capable of transmitting the fever, its seasonal incidence being identical with that of the disease. The ticks from dogs identified as *Ixodes ricinus*, L. [xvii, 253] were probably *R. sanguineus*, the former being rare on dogs in France, where they are commonly infested with *R. sanguineus* and *Dermacentor reticulatus*, F., in the south and by *I. hexagonus*, Leach, in the north. Infested dogs should be washed with an arsenical dip. The Chalcid parasite, *Ixodiphagus caucurtei*, du Buysson, is also of value in control of the tick [*cf.* xvi, 133 ; xvii, 123].

BRUMPT (E.). **Parasitisme latent de l'*Ixodiphagus caucurtei* chez les larves gorgées et les nymphes à jeun de divers ixodinés** (*Ixodes ricinus* **et** *Rhipicephalus sanguineus*).—*C.R. Acad. Sci. Fr.*, cxci, no. 22, pp. 1085–1087. Paris, 1930.

Experiments carried out by the author on latent parasitism by *Ixodiphagus caucurtei*, du Buysson [*cf. R.A.E.*, B, xvi, 162] in *Ixodes ricinus*, L., and *Rhipicephalus sanguineus*, Latr., showed that a period of about 83 days elapses before signs of parasitism appear in nymphs, whether engorged or fasting, that develop from parasitised, engorged larvae. This fact is of practical importance in the preservation of the parasite in the laboratory and in its transport for long distances.

BLANC (G.) & CAMINOPETROS (J.). **La transmission du kala-azar méditerranéen par une tique :** *Rhipicephalus sanguineus*.—*C.R. Acad. Sci. Fr.*, cxci, no. 23, pp. 1162–1164, 1 ref. Paris, 1930.

The susceptibility of *Citellus citellus* to Mediterranean kala-azar [*R.A.E.*, B, xix, 15] enabled experiments to be carried out to determine the method of transmission of the disease. Since in districts where it is prevalent, dogs are more frequently infected than man, the vector is probably a parasite of the former that attacks man only accidentally, such as *Rhipicephalus sanguineus*, Latr. The authors' experiments showed that larvae and nymphs of this tick were infected by feeding on naturally infected dogs or artificially infected ground squirrels, and retained the infection after moulting and becoming nymphs or adults, respectively. In each case infection was demonstrated by inoculating the crushed ticks into ground squirrels.

DELANOË (P.). **Le rôle du porc-épic comme reservoir de virus du spirochète marocain,** *Sp. hispanicum* **var.** *marocanum* **Nicolle et Anderson.**—*C.R. Acad. Sci. Fr.*, cxci, no. 26, pp. 1481–1484, 2 refs. Paris, 1930.

The frequency with which spirochaetes are found in *Ornithodorus* [*erraticus*, Lucas] from porcupine burrows in Morocco [*R.A.E.*, B,

xviii, 182, etc.] led the author to investigate the part played by that animal as a reservoir of *Spirochaeta hispanica* var. *marocana*. Of 17 porcupines tested, two being young, the spirochaete was found in the blood of one young female only. Further investigations showed the adult porcupines to be almost or completely immune from infection by various strains of the spirochaete. This polyvalent immunity is acquired, in the author's opinion, by the adults changing their burrows and being thus bitten by a large number of infected ticks. Porcupines are, therefore, considered to be an important reservoir of the virus [but *cf.* xviii, 19]. The spirochaete would probably be found in the blood stream of young porcupines, 15–30 days old, but these could not be procured, since they are kept by the mother at the end of the burrows.

JEWELL (N. P.) & CORMACK (R. P.). **Typhus Fevers, with a Description of the Disease in Kenya.**—*J. Trop. Med. Hyg.*, xxxiii, no. 20, pp. 301–305, 1 pl., 1 fldg. table, 7 charts, 25 refs. London, 15th October 1930.

The authors describe the symptoms of a typhus-like fever in Kenya. There is usually an inflamed mark, accounted for as an insect bite, commonly situated on the forearms or legs. The vector is not the louse [*Pediculus*], as the disease appears among the better classes and has not so far been found among those who are frequently infested with lice. Moreover, tick-bites are so well known, especially among persons who frequent golf courses or open plains, that it seems probable that if the bites were due to ticks they would have been identified as such. It seems evident that the vector must be sufficiently small to escape notice at the time of infection, and is probably a mite. No reservoir has yet been found, but rats and the native population are being investigated.

The disease is compared with typhus and other similar fevers, the characteristics of 15 of these diseases being collated. The authors express the opinion that these fevers will be found to be the same disease altered only by differences in the reservoirs, vectors and climates concerned.

PAPERS NOTICED BY TITLE ONLY.

EDWARDS (F. W.). *Culicoides riethi* **Kieffer: A new British biting Midge.**—*Entomologist*, lxiv, no. 812, p. 1. London, January 1931.

MATHESON (R.). **Distribution Notes on Culicidae (Mosquitoes)** [chiefly in U.S.A.].—*Bull. Brooklyn Ent. Soc.*, xxv, no. 5, pp. 291–294. Lancaster, Pa., December 1930.

BAU (A.). **Die Ausbeute der deutschen Chaco-Expedition 1925–26. Diptera. XX. Pupipara. A. Hippoboscidae** [3 spp.]. **B. Nycteribiidae** [1 sp.].—*Konowia*, ix, no. 3, pp. 209–213, 1 fig. Vienna, 20th October 1930.

SCHUURMANS STEKHOVEN (J. H.). **Tabanids Collected in Celebes and adjacent Isles. (Third Addition to my Monograph: The Tabanids of the Dutch East Indian Archipelago.)**—*Zool. Anz.*, xcii, no. 3–4, pp. 109–111, 1 fig. Leipzig, 10th November 1930. [*Cf. R.A.E.*, B, xiv, 118.]

ANDRÉ (M.). **L'appareil respiratoire du** *Thrombicula autumnalis* **Shaw (Acarien: Fam. Thrombidiidae).**—*C.R. Ass. franç. Av. Sci.*, liii, pp. 433–434, 1 fig. Paris, 1929.

VITZTHUM (H.). **Milben als Pestträger ? Ein Beitrag zu den Untersuchungen der mandschurischen Peststudienkommission in Harbin. Der "Acarologischen Beobachtungen" 16. Reihe.** [Mites as Vectors of Plague ? A Contribution to the Investigations of the Manchurian Plague Commission in Harbin. Acarological Notes.] —*Zool. Jahrb.*, Abt. Syst., lx, no. 3–4, pp. 381–428, 15 figs. Jena, 5th December 1930.

The author gives a brief account of the mechanism of plague transmission and deals at length with the classification of mites found in rodents' nests in Manchuria. He comes to the conclusion that mites can play no part in the transmission of plague in man, even if they have been living on plague-infected rodents.

METCALF (Z. P.). **A Text-book of Economic Zoology.**—Med. 8vo, x+17–392 pp., 236 figs. London, H. Kimpton, 1931. Price 18*s*.

This English edition of a text-book printed in America is designed to furnish material for teaching the fundamental principles of zoology from the applied standpoint, and throughout it stress has been placed on economic importance and bionomics rather than on morphology. Numerous illustrations (mostly original line drawings) have been introduced because it is believed that if these are carefully made and studied they will give the student a maximum of information in a minimum of space. The omission of lengthy anatomical details and of bibliographical references has enabled the author to assemble a mass of detail within a small compass.

One chapter (pp. 172–189) is devoted to the Arthropoda in general, and another (pp. 190–207) to the Arachnida and Myriapoda. The most lengthy chapter is that entitled "The Insects in relation to Man" (pp. 208–274), while the final one (pp. 342–352) discusses the Protozoa and protozoal diseases.

SMITH (K. M.). **A Textbook of Agricultural Entomology.**—Demy 8vo, xiii+285 pp., 80 figs. Cambridge Univ. Press, 1931. Price 12*s*. 6*d*.

This book, which is reviewed elsewhere [*R.A.E.*, A, xix, 143], includes details on the bionomics and control of the insect enemies of farm animals in the British Isles.

VEDDER (E. B.). **A Discussion of the Evidence concerning the Transmission of Leprosy.**—*Porto Rico J. Publ. Hlth. Trop. Med.*, vi, no. 1, pp. 106–121, 23 refs. San Juan, P.R., September 1930.

In discussing various hypotheses to account for the transmission of leprosy, the author puts forward the arguments for and against the theory that it is carried mechanically by insects.

LEWTHWAITE (R.). **Clinical and Epidemiological Observations on Tropical Typhus in the Federated Malay States.**—*Bull. Inst. Med. Res. F.M.S.*, no. 1 (1930), 42 pp., 7 charts, 1 graph, 13 refs. Kuala Lumpur, 1930.

An account is given of further cases of tropical typhus occurring in the Federated Malay States [*cf.* *R.A.E.*, B, xvii, 185], including a brief discussion of the possible vectors of the disease.

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Bennett (H. L.). **Anti-malarial Drainage.**—*Kenya E. Afr. Med. J.*, vii, no. 7, pp. 190–198. Nairobi, October 1930.

The types of water encountered in anti-malarial drainage work are described. Swamps formed by seepage water or sluggish streams may be dealt with by means of open surface drains or subsoil drains. Those formed by water having no outlet owing to the ground rising on all sides may be drained by sinking a well through the impermeable stratum to the permeable layer beneath and allowing the water to soak away. Superfluous water may also be removed by planting such trees as *Eucalyptus robusta* and *E. saligna*, which transpire rapidly and have the effect of drying out large swamps. All these methods are discussed.

Richmond (A. E.) & Mendis (J. C.). **A Report on Investigations carried out in Peshawar during the Year 1927, in Connection with Malaria Prevention among Troops.**—*Rec. Malaria Surv. India*, i, no. 3, pp. 205–290, 2 fldg. plans, 1 fig., 12 charts, 5 refs. Calcutta, October 1930.

Although the scope of anti-malarial measures in the Peshawar Cantonment has been much enlarged during recent years, the anticipated reduction in malaria incidence has not been realised. With a view to determining the lines on which the malaria preventive measures should be amended, various investigations were undertaken, and a detailed account is given in this paper of observations and experiments on the breeding-places and seasonal occurrence of Anopheline larvae, on the habits and bionomics of the adults, and on trapping, fumigating and spraying as a means of destroying adult Anophelines in barrack rooms and tents. The relation of meteorological conditions to malaria incidence amongst British troops and various factors that have a bearing on their infection with the disease are discussed. The Anophelines found, in order of prevalence of the adults, were *Anopheles stephensi*, List., *A. maculipalpis*, Giles, *A. culicifacies*, Giles, *A. subpictus*, Grassi (*rossi*, Giles), *A. pulcherrimus*, Theo., *A. listoni*, List., *A. fuliginosus*, Giles, *A. superpictus*, Grassi, *A. turkhudi*, List., and *A. willmori*, James.

Senior-White (R. A.). **Malaria at Delhi : its Incidence and Causation.**—*Rec. Malaria Surv. India*, i, no. 3, pp. 291–335, 2 pls., 2 graphs, 5 maps, 16 refs.

Sinton (J. A.). **Note on Malaria in Delhi, with special Reference to the Report of Mr. Senior-White.**—*T.c.*, pp. 337–340. Calcutta, October 1930.

The situation of the New City of Delhi and the cantonments was based on Hodgson's malaria survey of 1913–14 [*R.A.E.*, B, iii, 39], and since that time, although an annual exacerbation must have taken place in the autumn, no epidemic occurred until 1926. An account is given in this paper of an investigation undertaken in 1927, in order to decide the relative importance of the various Anopheline breeding-places in relation to the disease. The present incidence of malaria and the types of parasite found, together with the species of

Anophelines and their breeding-places, are discussed, and finally numerous recommendations are made for dealing with the more important breeding-places by means of further drainage and filling schemes and the use of Paris green applied by aeroplane. Of the eight species of *Anopheles* taken, all but *A. moghulensis*, Christ., were included in a list given in the previous abstract [*loc. cit.*], in which, however, *A. maculipalpis*, Giles, was recorded as *A. maculipennis*, Mg. Details of the breeding-places examined are given in an appendix.

Various comments are made by Sinton on Senior-White's recommendations, and further lines of investigation into the cause of flooding and of the rise in the subsoil water level are suggested. The necessity for the services of a malarial engineer to deal with the various engineering problems arising in this connection are pointed out.

McCombie Young (T. C.) & Abdul Majid (S.). **Malaria in Sind, with Reference to the Sukkur Barrage Scheme.**—*Rec. Malaria Surv. India*, i, no. 3, pp. 341–407, 5 maps, 6 charts, 11 refs.
Sinton (J. A.). **Note on the Report on " Malaria in Sind " by Lieut.-Col. McCombie Young and S. A. S. Syed Abdul Majid. (1st Note.)**—*T.c.*, pp. 409–412. **Note on Malaria and anti-malarial Measures in the Larkana District of Sind. (2nd Note.)**—*T.c.*, pp. 413–415. Calcutta, October 1930.

A detailed account is given of a study on malaria in Upper Sind, with particular reference to observations carried out in wheat-growing areas, where the spleen rate is comparatively low, and rice-growing areas, where the spleen rate is high and the seasonal prevalence of malaria is greater. The incidence of epidemic malaria and its possible relation to the flood levels of the Indus and to rainfall are discussed. In the second part of the paper, details are given of a survey in the rice-growing area, showing the Anophelines found and the results of spleen measurements and blood examinations in the same district. The bearing of these results on the epidemicity of malaria in Upper Sind is discussed, together with the probable effect of the Sukkur Barrage irrigation scheme on the incidence of the disease. The only species of Anophelines found in any numbers were *Anopheles subpictus*, Grassi, *A. pulcherrimus*, Theo., and *A. culicifacies*, Giles, which appears to be the most important vector of malaria. During the course of the investigations *Phlebotomus papatasii*, Scop., *P. sergenti*, Parrot, and *P. christophersi*, Sinton, were also observed.

In the two notes J. A. Sinton further discusses the effect of the Sukkur Barrage scheme on the incidence of malaria and points out that, although the new irrigation system may result in improving the economic conditions of the people and so diminish the prevalence of malaria, the importance of adequate drainage schemes should be particularly emphasised. Water-logging consequent on a rise in the subsoil water level above and below the barrage may lead to a decrease in the agricultural value of the land and consequently to a lowering in the economic conditions of the people, with resulting hyper-endemic malaria, as well as to an increase in Anopheline breeding. At the same time the problem presented by the disposal of superfluous water from rice-fields, which at present affords most of the Anopheline breeding-places, will be intensified.

Gill (C. A.). **The Relationship of Canal Irrigation and Malaria.**—*Rec. Malaria Surv. India*, i, no. 3, pp. 417–421, 3 refs. Calcutta, October 1930. Reprint from *Agric. J. India*, xxii, pt. 3, pp. 168–172, 3 refs. Calcutta, May 1927.

In view of the widely accepted opinion that increased incidence of malaria is an inevitable accompaniment of canal irrigation, the author briefly reviews the question, with particular reference to the great canal system maintained by the Punjab Government. An analysis of data collected during the past 13 years appears to justify the conclusion that, in general, canal irrigation is not of appreciable importance in determining the incidence and severity of either endemic or epidemic malaria in the Punjab, but in cases where it gives rise to water-logging, a high degree of endemic malaria almost inevitably results.

Gill (C. A.). **Rice Cultivation and Malaria in the Punjab.**—*Rec. Malaria Surv. Ind.*, i, no. 3, pp. 423–428. Calcutta, October 1930.

Although from an agricultural point of view the rice crop is of relatively small importance in the Punjab, it is of peculiar importance from the point of view of malaria owing to the fact that it is the only crop grown in water and its period of harvest corresponds precisely with the main malaria season. This combination of circumstances is no doubt responsible for the view that the cultivation of rice in the vicinity of human habitations is inimical to health.

Epidemiological observations during the past 10 years have established the fact that a striking association exists between the amount of monsoon rainfall and the incidence of epidemic malaria, and as rice cultivation also depends on this factor, it might also be assumed that it is also conducive to epidemic malaria. From a comparison of the figures showing the relative liability of districts to epidemic mortality (1868–1921) with those showing the acreage under rice in 1923, it is concluded that rice cultivation is not a factor of any importance in favouring the occurrence of malaria in epidemic form, districts showing a negligible area under rice being subject to severe epidemics of malaria. Moreover, there is some reason for thinking that rice cultivation may actually be unfavourable to epidemic malaria, since the district showing the least liability to epidemic malaria has the largest acreage under rice.

On the other hand, districts showing a low coefficient of variability of malaria mortality indicate areas in which endemic, as opposed to epidemic, malaria occur. The only district in which some degree of epidemic malaria has not occurred is also the chief rice-growing district of the Province, and it might therefore be inferred that rice cultivation is favourable to the occurrence of endemic malaria, particularly as the spleen rate of this area has not only remained constant but has also been uniformly higher during the past 10 years than that of any other district. Malaria surveys have shown, however, that rice cultivation in the vicinity of towns is not always associated with a spleen rate of appreciable proportions, and it thus appears that it is not the cultivation of rice alone, but rather circumstances associated with it, that supply the environmental conditions favourable to endemic malaria. In other words, there is apparently no direct or constant relationship between the local facilities for the breeding of Anophelines and endemic

malaria, the Anopheline factor, although an important and essential one, being incapable, in the absence of other essential factors, of determining the local incidence of the disease.

STRICKLAND (C.) & CHOWDHURY (K. L.). **Malaria and Blackwater Fever at Noamundi.**—*Ind. J. Med. Res.*, xviii, no. 2, pp. 377–389, 1 map, 3 refs. Calcutta, October 1930.

During August 1929, observations were made on the conditions associated with blackwater fever and malaria in an iron mines camp in Bihar and Orissa, and, as a control, in an adjoining valley. From December 1927 to January 1930, 21 cases of blackwater were recorded, the infection rate being 61 per mille among clerks, etc., and only 0·2 per mille among the coolies. The malaria rate in 1927 was 2,000 per mille and in 1928, 5,000 per mille.

Adults of 10 species of Anophelines were caught in the mine area between 18th August and 15th September, 1929 ; *Anopheles culicifacies*, Giles, predominated (529 individuals), whereas only 6 individuals of *A. maculatus*, Theo., and 19 of *A. funestus*, Giles, were taken. Larvae of 15 species were collected altogether, and a comparison of the numbers of those taken in the two adjacent areas shows the great increase in the mine valley of *A. culicifacies*, with an almost corresponding decrease in the incidence of *A. funestus*, *A. maculatus* being about equally prevalent in both localities. Pools of standing water, due to the mining operations, were common in the mines area and produced numbers of *A. culicifacies* and *A. subpictus*, Grassi (*rossi*, Giles), whereas they were absent in the other valley.

The malarial aetiology of blackwater fever is assumed, and the correspondence in the seasonal prevalence of the two diseases was very noticeable. Both were more common in the upper part of the valley where the artificial breeding-places of *A. culicifacies* are more numerous. It is probable that *A. funestus* is concerned in transmission, but it is so relatively scarce that *A. culicifacies* is believed to be the chief source of infection.

In the area under observation a spleen rate of 44 per cent. (which is not considered a hyper-endemic index) was associated with much blackwater, a fact which is explained on the ground of the "domesticity" of *A. culicifacies*, which is about 30 times as great as that of *A. maculatus* and twice that of *A. funestus*. The greater incidence of blackwater among the superior classes may be accounted for by the fact that the coolies naturally and constantly fumigate their dwellings, and adult Anophelines were difficult to find in their huts, whereas they were constantly found in large numbers in the better habitations.

WEBSTER (W. J.). **Observations on Rat-fleas and the Transmission of Plague. Part III.**—*Ind. J. Med. Res.*, xviii, no. 2, pp. 391–405, 11 refs. Calcutta, October 1930.

Observations on the bionomics of *Xenopsylla cheopis*, Roths., *X. astia*, Roths., and *X. brasiliensis*, Baker, were continued in Bombay during 1929–30 [*cf. R.A.E.*, B, xviii, 138]. It is concluded from experiments that starved individuals of both sexes of the three species feed readily on man even at temperatures of over 80° F., and it does not appear that, other things being equal, the rat-to-man transmission of plague in India would depend on the greater attractiveness of man for one or other of

the species. With regard to the previous experiments in feeding both sexes of the three species on human blood alone [*loc. cit.*], a male of *X. astia* was subsequently kept alive for 25 days under similar conditions. Females of *X. cheopis* fed on human blood laid many eggs, none of which hatched. No eggs have been observed in the case of *X. astia* fed exclusively on human blood, but a wild female of *X. brasiliensis*, isolated from males on 5th November and fed daily on human blood, laid at least 18 eggs in January and 13 in February, several of which hatched. The last egg to hatch was laid 114 days after the flea could have been fertilised.

Observations on the longevity of plague-infected fleas when separated from their hosts indicated that, under natural conditions in the hot weather at Bombay, individuals of both *X. cheopis* and *X. astia* might live as long as a week, although the majority would die off in from 2 to 4 days. Other experiments with starved fleas demonstrated no striking difference in the longevity of individuals of the three species, and it does not appear, therefore, that the period of survival of the starved flea can be a significant factor causing a difference in the importance of the three species as vectors of plague under Bombay conditions.

Observations on the life-history of the three species are recorded in detail. It appears that, under conditions in Bombay, the hot weather is least favourable for *X. brasiliensis*, and the cold season least suitable for *X. astia*, whereas *X. cheopis* thrives at all periods. The developing stages of the fleas may survive exposure to extreme conditions, such as a temperature of 98·4° F. or 40° F. for periods of 24 hours.

Tyroglyphids were frequently numerous in breeding jars, but did not interfere with the rearing of young fleas. The natural enemies observed included ants, spiders and a Psocid.

Webster (W. J.) & Chitre (G. D.). **Observations on Rat-fleas and the Transmission of Plague. Part IV.**—*Ind. J. Med. Res.*, xviii, no. 2, pp. 407–425, 6 refs. Calcutta, October 1930.

As the previous experiments designed to allow comparison of the plague-transmitting powers of *Xenopsylla cheopis*, Roths., *X. astia*, Roths., and *X. brasiliensis*, Baker, proved inadequate, on account of the small number of positive results [*R.A.E.*, B, xviii, 138], a second series of similar experiments was carried out in Bombay in 1929–30, using 12 males and 12 females of each species instead of six, and all the fleas of each of the six series after being exposed to infection were put on a healthy rat at one time and not fed individually. Surviving fleas were collected 10–14 days after the death of the plague-inoculated rat and tested for plague infection by teasing up the proventriculus and stomach in saline and culturing the emulsion. If the rat on which the fleas were feeding died before they were required for culture, they were collected and placed with another healthy rat, so that, on occasion, a second, and even a third, transmission in series with the same small number of fleas was obtained. Of the 32 experiments completed, 12 were undertaken in the plague season with a mean temperature ranging between 68·8 and 76·8 ° F., and 20 in the off-season with a mean temperature of over 80° F. The details of the experiments are shown in tables. In the off-season 13 of the 20 experiments were completely negative, whereas, during the plague season, transmission was obtained with one or more species in 11 out of the 12 experiments. In the off-season, all species actually transmitted plague (though transmission did not take place

with females of *X. cheopis*), five out of the eight successful results being obtained with *X. brasiliensis*, which was the most regular vector of the three at temperatures over 80°. During the cold weather, successful transmissions were obtained with all three species during the first two experiments (although no transmissions in this series were obtained with males of *X. astia*) ; subsequently no transmissions were obtained with *X. astia*, but the total transmission with one or both sexes of the other two species, counting the first in series only, was 7 with *X. cheopis* and 10 with *X. brasiliensis*. Successful results were more often obtained with males than with females [*cf.* xviii, 139]. The number of second and third transmissions in series indicates that *X. brasiliensis* is the most regular vector.

The increased proportion of transmission with the change in climatic conditions in the plague season did not apparently depend on certain factors that have hitherto been regarded as of primary importance, *e.g.*, the proportion of fleas infected, the survival of the infected fleas and the survival of the plague bacillus in the infected flea, and it is concluded that the factor affected is the blocking phenomenon.

When fleas were collected from dead inoculated rats and later from the test rats, it was noted whether they were found on the host or in the layer of bran and sand on the floor. In the first case, active fleas were regularly recovered from the carcases even when they had begun to putrify, and, in the second, a very large proportion of all the fleas, even the females, which must migrate regularly to oviposit, was found on the host.

In the pit experiment [*loc. cit.*], the epizoötic among Madras rats continued without a break, and, up to 23rd December 1929, 576 rats had died of plague in the pit containing *X. cheopis* and 618 in that containing *X. astia*. On this date all rats were removed from the pits, and most of the fleas found on them were returned to their respective pits. On 3rd January 6 Madras rats were added to each pit, but as these were all alive 3 weeks later, it was concluded that the fleas had failed to carry over the infection. Later the *X. cheopis* pit was kept free from rats for 5 days, but the healthy rats introduced again remained uninfected.

A number of fleas suspected of being blocked were fed on rodents. The majority succeeded in obtaining a blood meal and failed to infect the animal. The behaviour and fate of 16 blocked fleas, which were each fed on a separate healthy animal, is given in detail ; only four transmitted plague (2 females and 1 male of *X. astia* and 1 female of *X. cheopis*) and all were dead on the day following the infecting bite.

Cultural and inoculation experiments indicated that the virulence of the plague bacillus was not diminished after being harboured by the flea for 10 days.

The mixed flea experiments indicate that *X. astia* is a much less regular transmitter than either *X. cheopis* or *X. brasiliensis* (their relative values being 0·3 : 1 : 1·7 respectively), but as blocking has been observed in both sexes of *X. astia* and continuous transmission experiments have been successful with *X. astia* alone, it is concluded that both sexes of all three species are potential plague vectors, but that the proportion of infected individuals of *X. astia* that becomes capable of transmitting is less than that of the other two species. In other words, where a specifically pure flea population is concerned, a higher *X. astia* index is required for the continuance of epizoötic and epidemic plague.

If it is assumed that the blocking phenomenon is the chief explanation of the mechanism of infection, it seems that the principal effect of climate

on the spread of plague is its influence on the proportion of blocked individuals among infected fleas and on the behaviour and fate of the individual blocked fleas. The plague season need not, therefore, correspond with the season of maximum prevalence of rat-fleas, although this may happen as a coincidence.

KORKE (V. T.). **Observations on the Natural History of** *F. bancrofti* **in Dwellings in Relation to the Systems of Drainage. Part VII.**—*Ind. J. Med. Res.*, xviii, no. 2, pp. 427–442, 2 refs. Calcutta, October 1930.

An intensive study of dwellings was made to determine the relation between the filarial incidence in Bihar and Orissa and the methods of disposing of household water. These can be classified principally under four headings, *viz.*, cemented drains, non-cemented drains, cess-pools (mostly non-cemented), and absence of any system. Inefficiency in the proper working of any of the systems leads to the accumulation of water and the breeding of *Culex fatigans*, Wied., the only vector of *Filaria bancrofti* in this area. Moreover, water is collected near dwellings in artificial excavations, such as tanks, reservoirs, canals or wells. In the case of dwellings investigated, the inmates were examined, females of *C. fatigans* were caught and dissected, and mosquito larvae, collected from the drainage system prevailing round the dwelling, were bred out and identified.

It was found that *C. fatigans* will breed in all the systems of drainage under summer and winter conditions. Of any single system, the cement drain appears to be most objectionable from a filarial point of view, if it is not kept clean and the water is allowed to accumulate for a period of about 8 days. Families and sections of the population using this system show a higher percentage of infection than those using any other system. In areas watered by reservoirs or artificial tanks, the percentage of infection in inmates of dwellings situated on the different systems is proportionately and highly intensified, although there is no evidence to show that *C. fatigans* is breeding in these reservoirs or tanks. A combination of drainage systems in an area is more dangerous than a single system, cement drains with cess-pools or with non-cement drains being the most important. No class of the population is exempt from infection if using one of the systems most objectionable from the filarial point of view, and the prophylactic measure recommended is the maintenance of cement drains and cess-pool systems in a sanitary state.

RAMSAY (G. C.). **Some Findings and Observations in an Anopheline Malaria Infectivity Survey carried out in the Cachar District of Assam.**—*Ind. J. Med. Res.*, xviii, no. 2, pp. 533–552, 3 fldg. graphs, 8 refs. Calcutta, October 1930.

During an Anopheline infectivity survey carried out in the Cachar District of Assam from 1st April 1927 to 31st March 1930, 42,300 adult Anophelines, comprising 18 species, were caught in human habitations, cowsheds and hospitals. Dissection showed malaria infections in 89 individuals, of which 86 were *Anopheles minimus*, Theo., 1 *A. ramsayi*, Covell, and 2 *A. kochi*, Dön. It is therefore concluded that *A. minimus* is almost entirely responsible for the transmission of malaria in the tea estates of this area. Of the infected mosquitos, only two individuals of

A. minimus and the single *A. ramsayi* were caught in cowsheds. The other common species of Anophelines feed chiefly in cowsheds, and the importance of zoophilism is stressed in the case of such species as *A. maculatus*, Theo., and *A. aconitus*, Dön., which have been proved to be natural carriers of malaria in countries where human blood, in the comparative absence of cattle, is the only food available.

The period during which *A. minimus* was found to be infected in nature was from 14th April to 22nd December, but the actual period during which it was capable of transmitting malaria (*i.e.*, when sporozoites were found in the salivary glands) was from 14th May until 9th December. The relation of temperature and humidity to the abundance of Anophelines and to their ability to transmit malaria is discussed.

NAPIER (L. E.). **The artificial Feeding of Sandflies.**—*Ind. J. Med. Res.*, xviii, no. 2, pp. 699–706, 1 pl., 2 figs., 2 refs. Calcutta, October 1930.

The author describes in detail an apparatus and technique for feeding sandflies, which is a slight modification of that already noticed [*R.A.E.*, B, xv, 160]. A few preliminary feeding experiments, which are briefly described, indicate that, in the absence of red blood corpuscles, little proliferation of either *Leishmania donovani* or *L. tropica* occurs in *Phlebotomus argentipes*, Ann. & Brun., but that both species develop equally well in this sandfly if red blood corpuscles are present. In *P. babu*, Ann., *L. donovani* does not proliferate or, at least, does not proliferate so readily as in *P. argentipes*.

CARTER (H. F.). **Further Observations on the Transmission of Malaria by Anopheline Mosquitoes in Ceylon.**—*Ceylon J. Sci.*, Sect. D (Med. Sci.), ii, pt. 4, pp. 159–176, 1 pl., 2 plans, 1 graph, 1 ref. Colombo, 7th November 1930.

In continuation of previous work [*R.A.E.*, B, xvii, 115], a malaria survey was carried out from December 1927 to December 1929 on part of a coconut estate in the vicinity of a coastal town 50 miles north of Colombo. Among the Anopheline larvae found, *Anopheles culicifacies*, Giles, *A. listoni*, List., *A. hyrcanus*, Pall., and *A. subpictus*, Grassi, were prevalent, and most of the adults caught in the coolie lines were *A. culicifacies* and *A. subpictus*. Dissections showed that *A. culicifacies* alone harboured malaria parasites, 3 per cent. being infected during the period of investigation. Of the 58 infected individuals, 47 were obtained during the months of December-February, and no infected mosquitos were found in June, July or October in either year. The highest sporozoite rates occurred in December 1927 (6·1 per cent.), January 1928 (7·5) and February 1929 (5·3).

A second investigation was carried out in October and November 1929 at the site of certain constructional works in the same district. *A. culicifacies* and *A. subpictus* were found breeding abundantly in borrow-pits in the immediate vicinity of the lines. Of the 534 mosquitos caught, 74 per cent. were *A. culicifacies* and 22 or 5·5 per cent. of these contained malarial parasites. The average sporozoite rate was 4 per cent. ; the highest (19·1 per cent.) was found in a collection made about the middle of October.

Carter (H. F.). **Observations on Epidemic Malaria in the South-western Lowlands of Ceylon.**—*Ceylon J. Sci.*, Sect. D (Med. Sci.), ii, pt. 4, pp. 177–189, 1 pl., 1 fig., 1 map, 3 refs. Colombo, 7th November 1930.

The following is taken from the author's conclusions: Extensive surveys undertaken in 1921–22 showed that the endemicity of malaria was low in the south-western lowlands of Ceylon, and evidence subsequently obtained indicated that the factor chiefly responsible for this condition was the low relative prevalence of *Anopheles culicifacies*, Giles, and *A. listoni*, List. [*cf. R.A.E.*, B, xvi, 30]. It is suggested that epidemics of malaria occurring within this area are due primarily to the presence of conditions that unduly favour the propagation of one or both of these mosquitos. Epidemiological data obtained on four localised epidemics within a radius of 15 miles of Colombo are discussed. In every case the epidemic was associated with quarrying and an abnormal prevalence of *A. culicifacies*, which was breeding prolifically in the quarry pools. *A. listoni* was less definitely associated with these epidemics and was only present in considerable numbers in one of them. In three of the epidemics discussed people from various other parts of Ceylon were living near the quarries. *A. ramsayi*, Cov., and *A. pallidus*, Theo., have now been recorded from Ceylon in addition to those species already noticed [*R.A.E.*, B, xiii, 121].

Deraniyagala (P. E. P.). **Some probable Ceylon Larvivores.**—*Ceylon J. Sci.*, Sect. D (Med. Sci.), ii, pt. 4, pp. 191–201, 3 pls., 3 refs. Colombo, 7th November 1930.

Brief descriptions are given of some of the commoner fish of Ceylon that are likely to prove of value as destroyers of mosquito larvae, showing the types of water that they inhabit.

Morin (H. G. S.). **Note sur le développement d'une campagne antipalustre en Cochinchine.**—*Ann. Inst. Pasteur*, xlv, no. 5, pp. 641–659. Paris, November 1930.

The history of anti-malaria research in Cochin China is briefly reviewed. In 1928–29, investigations on 15 agricultural or industrial undertakings were carried out. The density of Anopheline larvae in collections of water within a radius of 400–550 yards of dwellings in malarious localities was always high. Except for the ubiquitous *Anopheles vagus*, Dön., *A. maculatus*, Theo., was the most prevalent species found in the larval stage in the vicinity of malarious dwellings. The proportion of *A. minimus*, Theo., captured is certainly less than the actual proportion of this species in the local fauna. Next to *A. vagus*, *A. minimus* was the most numerous species taken in diurnal shelters. Many of the mosquitos captured were engorged, and their movements were slow; once located they were fairly easy to capture. During the night, however, they are much more active and less easy to collect. Moreover, among the species collected at night *A. vagus* was practically absent, and *A. maculatus*, which was rare in day-time collections, and *A. kochi*, Dön., which was entirely absent, were common. *A. minimus*, however, remained the most prevalent species. It has been taken in all malarious localities and has never been found where malaria does not occur; its area of distribution is greater than that of *A. maculatus* [*cf. R.A.E.*, B, xviii, 208]. Dissection of 181

individuals of *A. minimus* revealed malaria parasites in 12, whereas no infections were found in dissections of approximately 100 individuals of the other common species. It is concluded that *A. minimus* is certainly, and *A. maculatus* probably, concerned in the transmission of malaria. Moreover, measures directed against the breeding of these two species in certain localities have produced a rapid improvement in general health.

MANALANG (C.). **Does the Amount of Malaria depend on the Number of transmitting Mosquitoes?**—4to, multigraph 38 leaves, 13 refs. Manila, P.I., Philippine Hlth. Serv. [1930].

The author discusses the views of various workers on the question of the importance in malaria transmission of the density of the insect vector, and concludes that the conflicting opinions that are held are largely due to the insufficiency of the data on which they are based. In many cases, attempts are made to judge the effect of anti-mosquito measures when little or no information is available on the prevalence of larvae or adults before such measures were instituted.

In the second part of the paper, details are given of mosquito density and infection rates obtaining in various localities in the Philippines during 1927–29. From the data presented it is shown that the numbers of the transmitting species are only of importance in studying the epidemiology of malaria when the infection rate is also known, since the factors of the presence and susceptibility of the human host are variable. Moreover, it was found that sudden and unaccountable decreases in the density of the transmitting Anophelines may occur, which might be mistakenly attributed to control measures.

GRITZAĬ (P. K.). **Biologie de l'*Anopheles maculipennis* Mg. et mesures anti-anophéliques à la station malarique de Charkow.**—*Bull. Soc. Path. exot.*, xxiii, no. 8, pp. 795–797. Paris, 1930.

Investigations on *Anopheles maculipennis*, Mg., in Kharkov and its environs were carried out between April 1926 and October 1927. Culicine larvae were found in stagnant water with decaying vegetation, whereas the Anophelines preferred pure water and were not observed in zones of poly- and α-meso-saprobien [*cf. R.A.E.*, B, xv, 153]. This explains the fact that Anopheline larvae were only found in the rivers after improvements, such as deepening of the beds, straightening, the raising of the banks, etc., were completed. They were found in large numbers in water rich in *Spirogyra*, their numbers being in direct proportion to the quantity of this alga. Observations also indicated an indirect relation between the number of cattle and the time they spend in stables, and the incidence of malaria in man.

[MARTZINOVSKIĬ] MARZINOWSKY (E. I.). **Sur la lutte contre la dengue.**—*Bull. Soc. Path. exot.*, xxiii, no. 8, pp. 797–803. Paris, 1930.

As a result of the conference on the danger of the introduction of dengue, held in 1929 [*R.A.E.*, B, xvii, 198], vigorous campaigns against *Aëdes argenteus*, Poir. (*aegypti*, auct.) have been carried out at Batum and Sukhum, brief accounts of which are given in this paper.

van Thiel (P. H.). **Hibernation et semihibernation de l'*Anopheles maculipennis* et de la variété *atroparvus*; un problème de l'anophélisme sans paludisme.**—*Bull. Soc. Path. exot.*, xxiii, no. 8, pp. 836–850, 12 refs. Paris, 1930.

In order to obtain more precise information on the development of the fat-body in *Anopheles maculipennis*, Mg., and its short-winged variety, *atroparvus*, van Thiel, in Holland [*cf. R.A.E.*, B, xvi, 242, etc.], microscopic determinations were made of the size of the fat-body of a given number of mosquitos taken at different times during the winter at Leyden, where the typical form predominates, at Wilnis and Ter Aar, where there are both large and small mosquitos, and at Bolsward, where the variety predominates.

It was observed that in a locality where both forms are found together, at a time when fat mosquitos occur, there are also a number of individuals that are only moderately fat. It is possible that they are transitional forms between the type and variety, as they were not found at Bolsward. From wing measurements and places of hibernation, these mosquitos would be classed as var. *atroparvus*, but from the degree of development of the fat-body they more nearly approach the typical form. It is suggested that the influence exerted by the latter on the genetic composition of the variety may have a bearing on the increase and decrease of malaria in a certain locality in the course of years.

The formation of fat-body in the typical form may begin during the early part of July and may also occur at a time when the eggs are in the course of development in the ovary. It may reach its maximum as early as mid-September. After this time, thinning begins and proceeds most rapidly in hibernating places where the temperatures are highest. A certain amount of fat remains until spring in individuals that do not suck blood.

[Khodukin (N. I.) & Lisova (A. I.).] **Ходукин (Н. И.) и Лисова (А. И.). Zur Frage über die Möglichkeit von Erkrankungen an Malaria im Winter.** [On the Question of the Possibility of Infection with Malaria in Winter. (*In Russian.*)]—*Meditz. Muisl' Uzbekistana*, i (vi), no. 6–7, pp. 76–89, 1 pl., 9 refs. Tashkent, May-June 1927. (With a Summary in German, p. 132.) [Recd. 1930.]

Observations were carried out in 1925 and 1926 in Tashkent to determine whether the hibernating generation of *Anopheles sacharovi*, Favr (*elutus*, Edw.) is capable of transmitting malaria to man. In Turkestan some of the overwintering individuals of this mosquito (the true hibernating generation) possess a fat-body, whereas others do not. The individuals of the former type can feed on blood only when their activity is renewed in a warm room, the revival being connected with the disappearance of the reserve of fat and the development of the ovary, since as soon as the ovary is atrophied the salivary glands also become atrophied and the mosquito cannot suck blood. It was found that under favourable temperature conditions the hibernating females of *A. sacharovi* may easily be infected with *Plasmodium vivax* or *P. malariae*. Individuals that had a meal of blood and were kept at a temperature between 0 and 8° C. [32–46·4° F.], which is the usual temperature of the hibernation quarters of mosquitos in Tashkent, lived till the spring, when some were able to resume

feeding and oviposit. Dissection of infected females showed that although under these conditions the oökinetes did not penetrate the walls of the stomach, when kept at a warmer temperature, their development was completed in approximately the normal period. After remaining in the stomach for 8 days at a temperature varying from 2° to 8° C. [35·6–46·6° F.], they were capable of penetrating the stomach wall and of continuing development at favourable temperatures. The oöcysts could resist temperatures of 0–8° C. for 30 days, but a fall in temperature to −8° C. [17·6° F.] for a period not exceeding 20 hours considerably decreased the number of the viable ones. The sporozoites could survive in the salivary glands up to 30 days at temperatures of 0–8° C.

In Tashkent, *A. sacharovi* appears in human dwellings and cattle sheds in the beginning of October, being abundant at the end of November. Only a few individuals occur in the town in summer and autumn, when the malaria index is at its highest. The percentage of mosquitos that might become infected before entering hibernation is, therefore, negligible. No sporozoites or oöcysts were found in the mosquitos taken in the usual hibernation quarters, where the temperature would be unfavourable for them, but as in Tashkent the mosquitos often migrate from the hibernation places into inhabited houses, they might become infected with malaria in winter and transmit the disease then or early in the spring.

[Sofiev (M. S.).] **Софиев (М. С.). On the Question of the Rôle of the Ticks *Argas persicus* in the Transmission of Tick-borne Relapsing Fever in Central Asia.** [*In Russian.*]—*Meditz. Muisl' Uzbekist. Turkmenist.*, iv (ix), no. 7–8, pp. 43–46, 8 refs. Tashkent April-May 1930.

An account is given of laboratory experiments, carried out in September-November 1929 in Tashkent, to determine whether *Argas persicus*, Oken, can transmit the form of relapsing fever occurring in Central Asia, the identity of the causal agent of which is uncertain [*cf. R.A.E.*, B, xvii, 106]. Attempts to infect man, guineapigs and a rat by the bites of ticks fed 19–35 days previously on artificially infected guineapigs gave negative results, but spirochaetes were present in the intestinal tract and body fluid of ticks dissected 37, 70 and 84 days after the infecting feed. Spirochaetes were also found in a guineapig on the tenth day after the injection of an emulsion prepared from the intestinal contents of five ticks that had fed on an infected guineapig 36 days previously.

[Khodukin (N. I.).] **Ходукин (Н. И.). Mécanisme hétérodynamique chez quelques espèces d'*Anopheles*.** [*In Russian.*]—*Meditz. Muisl' Uzbekist. Turkmenist.*, iv (ix), no. 7–8, pp. 58–66. Tashkent, April-May 1930. (With a Summary in French, pp. 123–124.)

The following is almost entirely taken from the summary: The author agrees with the theory of Roubaud as regards the hibernation of Anophelines [*R.A.E.*, B, xi, 162–164, etc.], and considers that the hibernating individuals of certain species do not feed on blood in nature owing to physiological changes in them. In Tashkent, females of *Anopheles hyrcanus*, Pall., bred from larvae that had been taken in the field in the beginning of November, when given a blood meal, died without developing any fat-body. Those fed on sugar rapidly developed

a reserve of fat and hibernated. Females of *A. sacharovi*, Favr, feed on blood in the laboratory and may even oviposit in winter, if their reserve of fat is exhausted.

The dissection of Anopheline larvae in October-November showed that those of *A. pulcherrimus*, Theo., and *A. bifurcatus*, L., have fully formed fat-bodies, whereas those of *A. superpictus*, Grassi, *A. sacharovi* and *A. hyrcanus* possess a comparatively small reserve of fat. In the autumn the females of the three last-named species possess a fat-body at the moment when they emerge from the pupae, whereas those of *A. pulcherrimus* and *A. bifurcatus* are devoid of it and do not develop any fat even if fed on carbohydrates.

Observations on the function of the salivary glands of *A. hyrcanus* showed that the anticoagulative property of the saliva is more marked in the spring and summer and is weaker in winter. The activity of the salivary glands of the females begins to decrease from the moment of the formation of the fat-body, which probably suppresses the activity of both the sexual and salivary glands.

As the fat-body in *A. sacharovi* in Uzbekistan develops at the same time as it does in *A. maculipennis*, Mg., in Central Russia, the author is of the opinion that the former has migrated to Central Asia from the North. It appears that the stage in which individual species hibernate depends on the type of the water in which they usually thrive during the summer. Those that hibernate in the adult stage (*A. sacharovi* and *A. hyrcanus*) breed in temporary waters, whereas those that breed in permanent waters (*A. pulcherrimus* and *A. bifurcatus*) hibernate as larvae. *A. superpictus* occurs in both types of water and hibernates in both the adult and the larval stage.

[Zotov (M. P.).] **Зотов (М. П.). A Contribution to the Technique of Catching Sandflies.** [*In Russian.*]—*Meditz. Muisl' Uzbekist. Turkmenist.*, iv (ix), no. 7–8, p. 102, 1 fig. Tashkent, April-May 1930.

Several sandflies [*Phlebotomus*] may be caught one after another by means of a test tube, about 1 in. in diameter, into which a small paper funnel is placed, having a hole at the bottom just large enough for a sandfly to squeeze through. The test tube is held over the sandfly until it passes through the hole.

In a footnote, the editor recommends a method proposed by A. N. Fialkovskiĭ, in which a test tube, coated on the inside with a film of clove oil, is used. The sandflies stick to the film and are immediately killed. They are eventually washed out of the tube with alcohol.

[Sofiev (M. S.).] **Софиев (М. С.).** *Ornithodorus lahorensis* **(Neumann 1908) in Uzbekistan.** [*In Russian.*]—*Meditz. Muisl' Uzbekist. Turkmenist.*, iv (viii), no. 2–3, pp. 18–21, 2 figs., 13 refs. Tashkent, November-December 1929. (With a Summary in German, p. 146.) [Recd. 1930.]

Reference is made to the literature on the occurrence of tick-borne relapsing fever in Uzbekistan and Tadzhikistan; the identity of the tick or ticks that transmit the disease has not been definitely determined. Collections of ticks taken in 1927 and 1928 in inhabited houses and on sheep and cattle in the environs of Tashkent, Andijan and Old Bokhara included a few examples of *Ornithodorus papillipes*, Birula, and many of *O. lahorensis*, Neum. The latter was abundant

on cattle in December, January and February, but did not infest the animals in summer. The author considers that it is the species recorded in Russian literature as *O. tholozani*, Lab. & Mégn. [*R.A.E.*, B, xv, 51, 215; xvi, 110, 184, 219, 266; xvii, 76, etc.], and that the latter does not occur in Central Asia.

[Zavadskiĭ (M.).] **Завадский (М.).** *Anopheles pulcherrimus* **(Theob.) als Malariaüberträger (vorläufige Mitteilung).** [*Anopheles pulcherrimus* as a Vector of Malaria. (Preliminary Report.) (*In Russian.*)]—*Meditz. Muisl' Uzbekist. Turkmenist.*, iv (viii), no. 2–3, pp. 22–24, 5 refs. Tashkent, November-December 1929. (With a Summary in German, p. 146.) [Recd. 1930.]

The literature on the relation to malaria of *Anopheles pulcherrimus*, Theo., which is widely distributed in Central Asia, is briefly reviewed. In the autumn of 1928, sporozoites were found in the salivary glands of one of numerous females of this species, captured in inhabited houses in a village of the Tashkent district, where an epidemic of malignant tertian malaria was in progress. This appears to be the first record of a natural infection of *A. pulcherrimus* with malaria.

[Khodukin (N. I.).] **Ходукин (Н. И.). The basic Problems of the Epidemiology of Kala-azar in Connection with the Epidemiology of canine Leishmaniasis in Central Asia.** [*In Russian.*]—*Meditz. Muisl' Uzbekist. Turkmenist.*, suppl., 146 pp., 11 pls., text ill., 150 refs. Tashkent, 1929. Price 2 *rbls.* 50 *kop.* [Recd. 1930.]

This is a detailed account of work on infantile and canine kala-azar carried out in 1925–28 in the town of Tashkent. The literature on the relation between the canine and human kala-azar, the possible modes of infection and the causal organisms of these and allied diseases is reviewed; the author considers *Leishmania infantum* to be identical with *L. donovani*. Examination of different parts of the town showed the foci of kala-azar to occur in densely populated districts with an insufficient water supply and insanitary conditions. The period of occurrence and zones of incidence of infantile and canine kala-azar coincided. As a result of a systematic destruction of infected dogs in the town, the number of cases of canine leishmaniasis decreased and the incidence of the disease in children was reduced by 70 per cent., whereas in other towns in Central Asia, where no campaign against the infected dogs was carried out, no change in the rate of the incidence of kala-azar was observed. This tends to confirm the view that *L. canis* is identical with *L. donovani* (*infantum*). Laboratory investigations carried out by the author and others in 1927 and 1928 [*R.A.E.*, B, xvii, 9, 252] are discussed, and the development of *L. canis* in the digestive tract of *P. papatasii*, Scop., is described. The flagellates adopted an anterior position in the sandfly, as *L. donovani* (*infantum*) has been shown to do [xv, 221; xvii, 98], which affords further evidence of the identity of the two forms and indicates that *P. papatasii* may be the vector.

The literature on the fauna and classification of *Phlebotomus* in Turkestan is reviewed, and descriptions are given of both sexes of the species encountered in Tashkent, *viz.*, *P. papatasii*, *P. chinensis*, Newst., *P. major*, Ann., *P. sergenti*, Parrot, *P. caucasicus*, Marz. (*li*, Popov), *P. selectus*, sp. n., *P. sergenti* var. *mongolensis*, Sinton, *P. grekovi*, sp. n., *P. africanus*, Newst., and *P. minutus*, Rond., and of the eggs of *P. papatasii*, *P. chinensis*, *P. caucasicus* and *P. minutus*, with notes on their synonymy and geographical distribution in Turkestan

and the Russian Union. The author considers, however, that the identification of *P. africanus* and *P. minutus* is doubtful.

The method adopted for breeding the sandflies in the laboratory [xiv, 139] is described, and a detailed account is given of observations on their biology. Oviposition took place about the fifth day after pairing, the number of eggs deposited by a female being usually 30–46, though dissection showed the potential number to be considerably higher. The egg stage varied with the temperature from 6 to 20 days, the larval stage lasted about 3 weeks, and the pupal stage 6–9 days. In these and previous experiments some of the sandflies oviposited so late in autumn as to suggest the possibility of hibernation occurring in the egg stage. A general description of the larvae and pupae of sandflies is given, and the behaviour of the larvae is discussed. The very young individuals are easily killed by an excess of moisture and high temperature ; those of the second and third instars are more resistant and survive submersion in water lasting 1–2 hours. The fourth instar larvae lived for 3–4 days in a completely dry medium at a temperature of 28–30° C. [82·4–86° F.]. The larvae are more resistant to low than to high temperature ; at 40° C. [104° F.] they died in 10–12 hours, and the critical low temperature for those of *P. papatasii*, *P. caucasicus* and *P. sergenti* was about −7° C. [19·4° F.]. Observations on the hibernating larvae have already been noticed [xvii, 236]. Direct sunlight killed the larvae of all instars in about 2 hours. It was found that under the climatic conditions of Turkestan the larvae could not survive and pupate in the laboratory unless the medium was kept slightly damp.

The female sandflies begin to feed on blood 24 hours after emergence, and in summer live 10–18 days ; in one instance a female of *P. papatasii* lived 72 days in the laboratory. The optimum habitat is afforded by places with a sufficient quantity of moderately damp organic matter ; under these conditions the sandflies can thrive even in the desert and at a distance from human dwellings [*cf.* xviii, 114]. They have been recorded at altitudes as high as 7,000 ft. The seasonal incidence of the different species is discussed and shown in tables ; *P. papatasii* represented about 85 per cent. of all the sandflies taken.

The author concludes that dogs are important reservoirs of kala-azar and that cutaneous leishmaniasis in dogs is probably not an independent disease, but only either an initial or final form of the visceral infection, not unlike the post kala-azar dermal leishmanoid observed in India [*cf.* xvi, 249]. In Tashkent, a concentration of *Leishmania* in the skin and mucous membrane of naturally infected dogs was usual, and in some individuals the disease showed clear symptoms of transition from one form to the other. Epidemiologically, the presence of the parasites in the skin is more important than their occurrence in the peripheral blood, where their number is considerably less. Serological tests indicated that *L. tropica* is an independent species, whereas the Turkestan strain of *L. canis* is identical with *L. donovani*, and closely related to *L. canis* var. *cutanea*.

NITZULESCU (V.). **Contribution à l'étude de la femelle du** *Phlebotomus intermedius*.—*Ann. Parasit. hum. comp.*, viii, no. 5, pp. 523–529, 2 pls., 7 figs., 8 refs. Paris, 1st October 1930.

The female of *Phlebotomus intermedius*, Lutz & Neiva, is redescribed from a collection of both sexes received from Rio de Janeiro in 1927, the characters of the maxillae, buccal and pharyngeal armatures, and spermathecae being given foı the first time.

Nitzulescu (V.). **Sur le *Phlebotomus ariasi* Tonnoir, 1921. Sa présence en France.**—*Ann. Parasit. hum. comp.*, viii, no. 5, pp. 530–539, 1 pl., 5 figs., 5 refs. Paris, 1st October 1930.

Detailed descriptions are given of two males of *Phlebotomus ariasi*, Tonnoir, and a brief description of a single female thought to belong to the same species. They were found among a batch of sandflies collected at Saint-Vallier (Alpes Maritimes) in 1913 and subsequently identified as *P. perniciosus*, Newst., to which species the others belonged. The characters distinguishing *P. ariasi* from *P. perniciosus* and *P. major*, Ann., are discussed.

Nitzulescu (V.). ***Phlebotomus demeijerei* n. sp. de Java (syn. *P. perturbans* de Meijere, 1909 pro parte).**—*Ann. Parasit. hum. comp.*, viii, no. 5, pp. 540–546, 5 figs., 11 refs. Paris, 1st October 1930.

In examination of a co-type of *Phlebotomus perturbans*, de Meij., which is only known to occur in Java, with a view to completing the description of this species by characterising the pharyngeal armature and spermathecae of the female, it was found that the buccal armature of this individual, here described as *P. demeijerei*, sp. n., differs from that described by Patton and Hindle from other co-types [*R.A. E.*, B, xvi, 169], although the wing venation, on which de Meijere based his original description, is similar.

Nitzulescu (V.). ***Phlebotomus langeroni* n. sp. et *P. langeroni* var. *longicuspis* n. var. de Douar-Shott (Tunisie).**—*Ann. Parasit. hum. comp.*, viii, no. 5, pp. 547–553, 3 pls., 3 figs., 1 ref. Paris, 1st October 1930.

Phlebotomus langeroni, sp. n., which was previously described as a variety of *P. perniciosus*, Newst. [*R.A.E.*, B, xviii, 246], and *P. langeroni* var. *longicuspis*, n., are described from male examples from Douar-Shott, Tunisia.

Rudolfs (W.). **Effects of Chemicals upon the Behavior of Mosquitoes.**—*Bull. New Jersey Agric. Expt. Sta.*, no. 496, 24 pp., 1 fig., 23 refs. New Brunswick, N.J., March 1930.

Results are given of many experiments and observations carried out during 4 consecutive summers on the effect of numerous heavy oils, essential oils, pure chemicals and mixtures on the behaviour of *Aëdes sollicitans*, Wlk., *A. cantator*, Coq., *A. canadensis*, Theo., *A. vexans*, Mg. (*sylvestris*, Theo.) and *Culex pipiens*, L., the practical conclusions as regards repellents confirming those already obtained [*R.A.E.*, B, xiv, 38].

Mosquito Investigations and Control.—*Rep. New Jersey Agric. Expt. Sta. 1928–29*, pp. 125–142. New Brunswick, N.J., 1930.

An account is given of the anti-mosquito work carried out in New Jersey during the year 1928–29, including brief references to some of the investigations already noticed [*R.A.E.*, B, xvii, 243–5]. Papers by F. W. Miller deal with the anti-mosquito campaigns carried out by county and municipal agencies, the mosquito breeding that occurred during the year, and experiments on the use of light traps. In tests

to ascertain the value of the traps [xvii, 139], as compared with hand collection, it was found that at no time did a single trap catch as many mosquitos during a night as one collector during 15 minutes. Coloured lights and various kinds of bait, such as liver, beef blood, peptone, ripe bananas, or milk, did not increase the effectiveness of the traps. Throughout two months' observations no mosquito was seen to enter the traps until after 11 p.m. It seems possible that the heat of the lamp, slight though it is, is attractive to the mosquitos during the cooler hours.

BRITTON (W. E.). **The Mosquito Problem of Connecticut and how to solve it.**—16 pp., 10 figs. Hartford, Conn., State Dept. Hlth., 1930.

A brief popular account is given of mosquitos and their control in Connecticut, together with reprints of the legislation dealing with the enforcement of measures for their elimination.

FRANÇOIS-JULIEN (G.). **De la persistence du paludisme à la Guadeloupe. Les causes—La prophylaxie.**—*Thèse Fac. Méd. Paris*, Med. 8vo, 110 pp., 2 maps, 2 pp. refs. Paris, 1930.

An account is given of the history and incidence of malaria in the Guadeloupe Islands, with descriptions of the mosquito breeding-places and suggested measures for controlling the disease. Malaria is endemic in the larger islands of the group, where conditions are particularly favourable for mosquito breeding. Some of them are of calcareous formation, flat, and having no important rivers ; the soil has a substratum of clay, which retains the rain water. Rain water is collected for drinking purposes, and stored in jars or cisterns. The other islands of the group, including Guadeloupe itself, are of volcanic origin. The different ways in which the rivers afford breeding-places for mosquitos in various parts of the Island are discussed ; the highest parts are uninhabited, and the Anopheline found there is *Anopheles* (*Cellia*) *argyritarsis*, R.-D., which breeds in tree-holes and is not concerned in the transmission of malaria.

The Anophelines concerned in the transmission of malaria are *Anopheles albimanus*, Wied., and *A. tarsimaculatus*, Goeldi. No survey of Anopheline breeding-places was undertaken, but the most malarious regions are in the vicinity of swamps and ponds. Moreover, in view of the fact that filariasis is common in the Islands and outbreaks of yellow fever also occur, measures against all mosquito larvae should be of value.

VAN SACEGHEM (R.). **Action de la température sur la propagation de l'East Coast Fever par les tiques.**—*Bull. agric. Congo belge*, xxi, no. 2, pp. 511–512. Brussels, June 1930.

The author has found in Ruanda that ticks (*Rhipicephalus*) that are vectors of *Theileria parva* do not transmit African coast fever above a certain altitude (8,000 ft. above sea level), and that when healthy cattle from these high pastures are brought down to about 5,000 ft., they contract the disease and die [*R.A.E.*, B, xv, 6]. During the hot, dry season at Ruanda ticks are excessively numerous. The heat factor evidently affects not only the number of ticks, but also the virulence of the organisms inoculated by them. The reverse is

evidently equally true, and the author believes that it is the low temperature obtaining on the mountains and high plateaux (where the night temperature may reach freezing point) that prevents the ticks from propagating the disease.

MÖNNIG (H. O.). **A Note on the Preservation of engorged Female Ticks.**—*16th Rep. Vet. Serv. S. Afr.*, pp. 199–200. Pretoria, 1930.

The colour of specimens of engorged female ticks can be preserved by dropping living individuals into a saturated solution of chloroform in 4 per cent. formaldehyde (10 per cent. commercial formalin) and firmly stoppering the tube. The ticks die almost immediately. Males and engorged females of various ticks preserved in this way for seven months still resembled living individuals as regards colour.

PAPERT (J. L.). **Tsetse-fly Survey of Zululand and surrounding Territories.**—*16th Rep. Vet. Serv. S. Afr.*, pp. 255–263, 2 maps. Pretoria, 1930.

CURSON (H. H.) & PAPERT (J. L.). *Glossina* **and Nagana in the Ngotshe and Piet Retief Districts.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiv, no. 3, pp. 309–312, 1 map, 4 refs. London, 25th November 1930.

Accounts are given of surveys to determine the distribution of *Glossina* and trypanosomiasis of cattle in various districts in Zululand, Natal, Swaziland and the Transvaal. The flies encountered were all *G. pallidipes*, Aust., with the exception of one individual of *G. brevipalpis*, Newst., taken in Zululand. Only one individual of *G. pallidipes* was taken in the Transvaal, where it has not previously been recorded.

TAYLOR (A. W.). **Experiments on the mechanical Transmission of West African Strains of** *Trypanosoma brucei* **and** *T. gambiense* **by** *Glossina* **and other Biting Flies.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiv, no. 3, pp. 289–303, 9 refs. London, 25th November 1930.

The experiments described were undertaken in Nigeria to obtain information on the question of the direct mechanical transmission of trypanosomes by blood-sucking Diptera. The following is largely taken from the author's summary :

Direct transmission of *Trypanosoma brucei* was obtained with *Glossina tachinoides*, Westw., but only when the interval between the break in the infecting feed and the resumption of the meal on a healthy animal did not exceed 10 minutes, and when the number of trypanosomes in the peripheral blood of the infected animal exceeded one in five microscopic fields. Successful transmissions were obtained with as few as four infecting bites. Some difference appeared to exist in the transmissibility of the three strains of *T. brucei* used, a newly isolated strain being more readily transmitted mechanically than older strains, which were more virulent to the experimental animals used. Negative results were obtained in each of 15 experiments in which attempts were made to transmit mechanically 6 strains of *T. gambiense* by means of *G. tachinoides*. *T. brucei* was successfully transmitted by *Stomoxys calcitrans*, L. (instantaneous transference), but not by *Anopheles gambiae*, Giles (*costalis*, Theo.), *A. funestus*, Giles, *Aëdes vittatus*, Big., or *Lyperosia* sp. Dissections revealed the fact that motile trypanosomes may survive in the proboscis of *G. tachinoides* for as long as three hours,

and that the maximum number of trypanosomes contained in the proboscis immediately after an infecting meal is often greater than 600 when trypanosomes are abundant in the peripheral blood of the infected animal. A brief account is given of the behaviour of trypanosomes in the proboscis and gut of *S. calcitrans*, the two Anophelines and *Lyperosia*. In none of them did the trypanosome survive in the proboscis so long, or in such large numbers, as in *G. tachinoides*.

TAYLOR (A. W.) & LESTER (H. M. O.). **Note on the Effect on the Infection Rate in the Tsetse of mixing two Strains of Trypanosomes in its infecting Feeds.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiv, no. 3, pp. 305–307, 1 ref. London, 25th November 1930.

Experiments were carried out to determine whether the higher rate of infection obtained in individuals of *Glossina tachinoides*, Westw., fed on two strains of *Trypanosoma brucei* [*cf. R.A.E.*, B, xviii, 172] was due to the mixing of the strains. The same two strains of the trypanosome were used, one batch of 720 flies being fed on alternate days on guinea-pigs infected with the two strains, and two batches, each of 360 flies, on the single strains. Dissections showed five mature infections with one strain, none with the second and three with the mixed strain, thus indicating that the mixing in the fly of two strains of a trypanosome does not tend to produce a higher infection rate in the fly than that which results when single strains are employed.

RICHARDSON (U. F.). **A Suggested Relationship between** *Theileria mutans* **and East Coast Fever.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiv, no. 3, pp. 343–346. London, 25th November 1930.

The author describes observations in Uganda that suggest the possibility that *Theileria parva* and *T. mutans* are identical, and that African coast fever is due to an ultra-filtrable virus, which normally causes a mild disease in cattle, but is capable of setting up a severe relapse to infection with *T. mutans* so that it assumes the form of an infection with *T. parva*.

GRAHAM-SMITH (G. S.). **The Oscinidae (Diptera) as Vectors of Conjunctivitis, and the Anatomy of their Mouth Parts.**—*Parasitology*, xxii, no. 4, pp. 457–467, 1 pl., 15 refs. Cambridge, 22nd November 1930.

The author reviews the literature in which various Oscinids, including *Siphunculina funicola*, de Meij., in India, Ceylon and Java, *Hippelates pusio*, Lw., in the United States, and *Oscinella* (*Oscinis*) *pallipes*, Lamb, in Egypt, are thought to carry conjunctivitis. *S. funicola* is also probably associated in Assam with Naga sore (which it has been shown to transmit experimentally), and *Hippelates flavipes*, Lw., with yaws in the West Indies. Senior-White's description of the anatomy of the proboscis of *S. funicola* is quoted, and the mouth parts of the other three species are described. In all, the mouth parts are very similar. There are six pseudotracheae with the tips of their chitinous rings upturned to form spines, covered by the integument, and projecting above the level of the pseudotracheal membrane. When the flies are feeding on abrasions or the conjunctival epithelium, these spines apparently act as cutting instruments, capable of producing minute multiple incisions, which are likely to assist infection with pathogenic organisms carried by the insects.

Gibbins (E. G.). **A simple Method of making permanent Microscope Mounts of Mosquito Larvae.**—*Bull. Ent. Res.*, xxi, pt. 4, pp. 429–430, 1 fig., 5 refs. London, December 1930.

A method is described whereby mosquito larvae can be permanently mounted in a fluid medium that combines the qualities of fixing, clearing and preserving. A cell is constructed by painting the outline of a square with asphalt varnish on a microscope slide (the depth may be varied by applying successive coats of varnish, or alternate layers of varnish and strips of filter paper). When dry, the cell is filled with Amann's lactophenol (composed of 20 cc. carbolic acid, 20 cc. lactic acid, 40 cc. glycerine and 20 cc. water), and the larva is killed with a few drops of lactophenol and laid in the mountant. A cover-slip is placed over the cell, any excess fluid is withdrawn by means of filter paper, the slide is dried, and the edges of the cover-slip are sealed with asphalt varnish. On the following day any moisture round the cover-slip is removed, and the preparation is completed by applying two coats of varnish, the first being allowed to dry before the second is given. Mosquito larvae are thus preserved in a life-like condition, and no deterioration has been observed in specimens that have been mounted for six months.

Howland (L. J.). **The Nutrition of Mosquito Larvae, with special Reference to their algal Food.**—*Bull. Ent. Res.*, xxi, pt. 4, pp. 431–439, 1 pl., 3 figs., 11 refs. London, December 1930.

An account is given of further work on the algal food of mosquito larvae [*cf. R.A.E.*, B, xvii, 172 ; xviii, 109] carried out in 1929.

The following is the author's summary : Algae are ingested by many species of mosquito larvae and appear to form an important part of the food of these larvae. The algae are digested in the gut, but the digestion is often by no means complete. It is quite possible that the rôle played by the algae may also be assumed by other forms of organic matter, for larvae may be reared to maturity in solutions containing little or no algae. Different algae react differently in the guts of the larvae, some being noticeably digested and some hardly at all. Those algae which are digested the most are easily stained and are forms of low osmotic pressure. Cytological investigations revealed no character that indicates that algae are an especially nutritious diet.

Jackson (C. H. N.). **Contributions to the Bionomics of** *Glossina morsitans*.—*Bull. Ent. Res.*, xxi, pt. 4, pp. 491–527, 4 figs., 10 refs. London, December 1930.

A detailed account is given of observations made in Tanganyika Territory to obtain data on the habits and numbers of *Glossina morsitans*, Westw., attracted to man, the numbers and movements of game animals present, the general nature and seasonal aspects of the local vegetation, and the topography of the area, and of experiments carried out to explain these observations through more direct evidence. The difficulties of interpreting fly numbers are discussed. Investigations on the distribution of the fly within the fly belt indicated the following types of fly community : compact "female centres" characterised by frequent passage of game, and showing a high apparent female

percentage and often apparent concentration of the fly; "spread centres," over larger areas, believed to be comparable in function to true, compact "female centres"; "male areas," spread over large areas of *Berlinia-Brachystegia* and sometimes other kind of woods, where the apparent female percentage is low; and areas where the fly is scarce. These observations led to the formulation of the "feeding-ground" concept, in which it was suggested that females might possibly be found to exist in equal or approximately equal numbers in male areas and female centres respectively, but that in female centres they were more inclined to show themselves; that this might be due to the greater hunger of flies in the female centres; and that the female centres were the feeding grounds, and the male areas the home, of the fly. Comparative statistics on the hunger of flies in the field, various field experiments, and consideration of the density of the fly, and the distribution of game in the male and female centres, gave a certain amount of evidence in support of this concept. The difficulty of drawing reliable conclusions from fly-rounds on the apparent variations of fly numbers in time, in relation either to season or to the movements of game, is pointed out.

ADLER (S.), THEODOR (O.) & LOURIE (E. M.). **On Sandflies from Persia and Palestine.**—*Bull. Ent. Res.*, xxi, pt. 4, pp. 529–539, 2 pls., 2 figs., 14 refs. London, December 1930.

The sandflies of Persia were investigated during a tour made from 27th May to 3rd July 1929. The species encountered were *Phlebotomus papatasii*, Scop., *P. perniciosus* var. *tobbi*, n., *P. kandelakii*, Shchur., *P. caucasicus*, Marz., *P. sergenti*, Parrot, *P. chinensis*, Newst., *P. wenyoni*, sp. n., and *P. palestinensis*, Adl. & Theo. *P. papatasii* occurs in all ranges of topographical and climatic conditions in the area examined. *P. caucasicus* is common except in the moist belt bordering the Caspian Sea. *P. kandelakii*, *P. wenyoni* and *P. chinensis* appear to be restricted to the highlands (5,000 ft. and more above sea-level), where the summer is comparatively mild. *P. sergenti* is relatively rare in north-west Persia, outside Teheran. The great importance of the time of collection in making any estimate of the relative prevalence of any sandfly is demonstrated, and the times at which the various species were commonly found are recorded. Both sexes of *P. caucasicus*, *P. kandelakii* and the new forms are described. It is pointed out that although *P. sergenti* and *P. caucasicus* [*R.A.E.*, B, xviii, 114] are closely related morphologically, their bionomics differ considerably even in districts where both are present. The distribution of *P. sergenti* corresponds very closely with that of oriental sore in Mesopotamia and Persia, whereas that of *P. caucasicus* does not appear to be related to the disease.

Two methods by which *P. papatasii*, *P. caucasicus* and *P. sergenti* can be bred without great difficulty on long motor journeys are briefly described.

No accurate data were available as to the distribution of leishmaniasis in the areas examined. Near the Caspian Sea, a few indigenous cases have been observed. In Kazvind and Teheran, cutaneous leishmaniasis is common in man and dogs. Human visceral leishmaniasis has never been recorded from Persia, but probably occurs there, at least in the neighbourhood of Transcaspia and Transcaucasia. Endemic centres of oriental sore in Persia differ from other localities

not only in their sandfly population but also in their meteorological conditions.

No natural infection was found in individuals of *P. caucasicus*, *P. papatasii* and *P. sergenti* dissected in Teheran. Stomach infections were obtained in some individuals of *P. caucasicus* fed on strains of *Leishmania tropica*. Six individuals of *P. perniciosus* var. *tobbi* were fed through capillaries on cultures of *L. donovani* isolated from a dog, which had been infected by inoculation from a case of infantile kala-azar in Naples. Three gave positive results. In one, dissected 3 days after the feed, the infection was confined to the stomach; in one dissected after 5 days there was a slight infection confined to the top of the cardia, the flagellates being attached to the rhabdorium; and in one dissected after 10 days there was a moderate infection in the cardia and stomach and flagellates were attached to the rhabdorium of the cardia. (One female of *P. major*, Ann., fed on the same strain and dissected 3 days later showed an infection in stomach and cardia.) Of seven females of *P. perniciosus* var. *tobbi* fed on a strain of *L. donovani* isolated from a child in Palestine, two were positive. Both were dissected after 7 days; in one there was a slight infection of stomach and cardia, and in the other the infection was confined to the stomach. When fed through capillaries, the majority of individuals of *P. perniciosus* var. *tobbi* did not feed at all, and those that fed ingested very little fluid. The amount ingested by this sandfly gave no positive infections in *P. papatasii* fed through membranes on the same strains. It appears, therefore, that the strains employed were better adapted to *P. perniciosus* var. *tobbi* than to *P. papatasii*. The presence of flagellates of *L. donovani* in the upper part of the cardia of the former at a time when they were absent in the stomach is thought to be significant. This phenomenon occurs in slight infections of *P. papatasii* with *L. tropica*, but has never been observed by the authors in the case of *L. donovani* from India or from Mediterranean countries. This is the first record of the infection of a sandfly of the *P. major* group with a Mediterranean strain of *L. donovani*, and *P. perniciosus* var. *tobbi* should therefore be regarded as a possible vector of kala-azar.

As the buccal cavity of the male has been found to be distinct in the two species, the name *Phlebotomus tiberiadis*, sp. n., is proposed for the species from Palestine previously described as *Phlebotomus* sp. near *clydei*, Sinton [xvii, 187].

EDWARDS (F.). **Mosquito Notes. X.**—*Bull. Ent. Res.*, xxi, pt. 4, pp. 541–545. London, December 1930.

The author adopts the view that *Taeniorhynchus*, Arrib., is preoccupied by *Taeniarhynchus*, Weinland, *Mansonia* being the next available name for the former genus. *Mansonioides*, *Rhynchotaenia* and *Coquillettidia* are regarded as subgenera of it. Notes are given on some species of the subgenus *Mansonioides* and on the four Oriental species of *Harpagomyia*. The author discusses the scope of *Dendromyia* and *Phoniomyia*, which he regards as subgenera of *Wyeomyia*; he does not agree with da Costa Lima [xix, 16] that *W. luteoventralis*, Theo., which is the type of *Dendromyia*, is the species subsequently described as *W. bromeliarum*, D. & K. Five new species are described, including *Rachionotomyia littlechildi* from Papua and *Anopheles* (*Myzomyia*) *machardyi* from Tanganyika Territory.

Papers noticed by Title only.

[Shevchenko (F. I.).] **Шевченко (Ф. И.). La morphologie extérieure des larves des mosquites** [*sic*] (*Phlebotomus papatasii, Phl. chinensis* **and** *Phl. sergenti*). [*In Russian.*]—*Meditz. Muisl' Uzbekist. Turkmenist.*, iv (ix), no. 7–8, pp. 67–83, 5 pls., 4 figs., 10 refs. Tashkent, April-May 1930. (With a Summary in French, p. 125.)

Vogel (R.). **Beobachtungen über blutsaugende Zweiflügler im Kanton Tessin.** [Observations on blood-sucking Diptera (including *Phlebotomus papatasii*, Scop.) in the Canton of Ticino.]—*Zool. Anz.*, xciii, no. 1–2, pp. 1–3. Leipzig, 15th January 1931.

Peus (F.). **Beiträge zur Faunistik und Oekologie der einheimischen Stechmücken. II. Teil.** [Contributions to the Distribution and Ecology of German Mosquitos. Part II.]—*Z. Desinfekt.*, xxii, no. 10, pp. 667–674, 1 fig., 10 refs. Dresden, October 1930. [*Cf. R.A.E.*, B, xviii, 64.]

Leeson (H. S.). **Variations in the Wing Ornamentation of** *Anopheles funestus*, **Giles.**—*Bull. Ent. Res.*, xxi, pt. 4, pp. 421–428, 5 figs., 3 refs. London, December 1930.

Hardy (G. H.). **The Queensland Species of** *Calliphora* **Subgenus** *Neopollenia* [including key and descriptions of 3 new species].—*Bull. Ent. Res.*, xxi, pt. 4, pp. 441–448, 3 figs. London, December 1930.

Hegh (E.). **La lutte contre les tsé-tsé** [*Glossina*]. **Recherche des gîtes à pupes et destruction des pupes qu'ils contiennent.**—*Bull. agric. Congo belge*, xxi, no. 2, pp. 405–411. Brussels, June 1930. [See *R.A.E.*, B, xix, 32.]

Wigglesworth (V. B.). **Digestion in** *Chrysops silacea* **Aust. (Diptera, Tabanidae).**—*Parasitology*, xxiii, no. 1, pp. 73–76, 15 refs. Cambridge, January 1931.

Roy (D. N.) & Mayne (B.). **A Note on the Presence of supernumerary Lobes in salivary Glands of Anopheline Mosquitoes.**—*Parasitology*, xxiii, no. 1, pp. 77–78, 1 pl., 1 ref. Cambridge, January 1931.

Jobling (B.). **A new Species of the Genus** *Raymondia* **Frauenfeld (Diptera Pupipara, Streblidae) with a Note on** *Raymondia quadriceps* **Jobling and** *R. bedfordi* **Ferris.** [*R. waterstoni*, sp. n.; *R. quadriceps*, a synonym of *R. bedfordi*.]—*Parasitology*, xxiii, no. 1, pp. 79–83, 2 figs., 2 refs. Cambridge, January 1931.

Ferris (G. F.). **The Louse of Elephants.** *Haematomyzus elephantis* **Piaget (Mallophaga: Haematomyzidae).**—*Parasitology*, xxiii, no. 1, pp. 112–127, 2 pls., 5 figs. Cambridge, January 1931.

Bedford (G. A. H.). **New Genera and Species of Mallophaga from South African Hosts.**—*16th Rep. Vet. Serv. S. Afr.*, pp. 153–173, 16 figs. Pretoria, 1930.

Wagner (J.). **Neue Floharten vom Pamir** [*Paraceras segregatus*, sp. n., on a Badger, and *Amphipsylla anceps*, sp. n., on *Cricetulus migratorius*].—*Konowia*, ix, no. 4, pp. 279–281, 1 fig. Vienna, 31st December 1930.

André (M.). **Une espèce de** *Thrombicula* **(Acarien) non encore signalée en France** [10 females of *Trombicula formicarum*, Berlese, from a nest of *Lasius niger*, L.].—*Bull. Soc. ent. Fr.*, 1930, no. 15, pp. 237–239. Paris, 1930.

André (M.). **Deux** *Microthrombidium* **(Acariens) nouveaux pour la faune française** [*Microtrombidium albofasciatum*, Berlese, and *M. densipapillum*, Berlese].—*Bull. Soc. ent. Fr.*, 1930, no. 15, pp. 241–242. Paris, 1930.

DUKE (H. L.). **On the Occurrence in Man of Strains of** *T. gambiense* **non-transmissible cyclically by** *G. palpalis.—Parasitology*, xxii, no. 4, pp. 490–504, 9 refs. Cambridge, 22nd November 1930.

An account is given of experiments carried out in Uganda since June 1927 on the subject of non-transmissible human strains of *Trypanosoma gambiense* [*R.A.E.*, B, xvii, 41]. The author concludes that strains of this trypanosome, non-transmissible by *Glossina palpalis*, R.-D., occur in man in nature in regions where this fly is its normal vector. Such strains may be still infective to the fly, but cannot invade the salivary glands. The application of successive tests to the same animal supplies further evidence that the infectivity of a strain to the fly is liable to diminish as the disease in the animal progresses towards a fatal termination.

In the course of the paper, the author discusses the question of the original host of the trypanosome and suggests that it was a parasite of vertebrates and is now in the process of adapting itself to the fly, the instability of such a character as transmissibility by tsetse being evidence of its comparatively recent acquisition.

GAUCH (A.). **Une substance qui protège efficacement les plaies contre la visite des mouches.**—*Rev. vét.*, lxxxii, pp. 638–639. Toulouse, November 1930.

An ointment composed of 1½ gm. nitrobenzene, 6 drops formaldehyde and 5 gm. cade oil, carefully mixed with 30 gm. vaseline or lanoline, has been found to be an effective repellent for flies when applied to the sores of animals that cannot be protected by an ordinary dressing.

SHREWSBURY (J. F. D.). **A Case of Human Intestinal Myiasis.**—*Brit. Med. J.*, no. 3650, p. 1043, 1 fig., 1 ref. London, 20th December 1930.

A case of enteritis in a child, resulting from infestation by the Anisopodid fly, *Rhyphus* (*Anisopus*) *fenestralis*, Scop., is recorded from England. The ova were probably ingested, and four larvae were voided at intervals during a period of three weeks.

WALTON (C. L.). **The Occurrence of Males of the Horse Bot Fly.**—*Northw. Nat.*, v, no. 4, pp. 224–226. Arbroath, December 1930.

Observations on *Gastrophilus* (*Gasterophilus*) *intestinalis*, DeG., in England by various authors show that the males assemble in upland places, where apparently they are sought out by the females.

DAVIES (W. M.). **The Control of Warble Flies in North Wales.**—*J. Minist. Agric.*, xxxvii, no. 9, pp. 862–870, 1 pl., 7 refs. London, December 1930.

In 1930 larvae of *Hypoderma* began to appear on the backs of cattle as early as the second week in January, and the average number of warbles in February was abnormally high, being 15·4 per animal. An account is given of experiments to determine the toxicity of derris soap wash [*cf. R.A.E.*, B, xviii, 204] made with derris obtained from

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four different sources and applied under experimental and under ordinary farm conditions. Satisfactory results were obtained with derris from three sources under all conditions, but that from the fourth source gave unsatisfactory results. A proprietary derris wash also proved of little value. It is estimated that 1 lb. derris powder is sufficient to provide wash for four monthly dressings on a farm with 20–25 infested cattle, and on this basis the cost should not exceed 2*d*. per animal.

Cumming (H. S.). **La tularémie aux Etats-Unis.**—*Bull. Off. int. Hyg. publ.*, xxii, no. 10, pp. 1904–1907, 10 refs.

Wefring (K. W.). **L'existence de la tularémie en Norvège.**—*T.c.*, pp. 1908–1910.

[Dubrovinskiĭ.] Doubrowinsky (—). **La tularémie dans l'Union des Républiques Soviétistes Socialistes (1921–1929).**—*T.c.*, pp. 1911–1921, 1 fldg. map, 18 refs. Paris, October 1930.

A brief general account is given of tularaemia as occurring in the United States. The disease was first observed in Norway in the autumn of 1929, and the diagnosis was confirmed by the agglutination in the serum of the infected individual of *Bacterium tularense* sent from the United States. The infection is contracted from hares and occurs among hunters, cooks and game merchants. Inoculation of unidentified ticks into guineapigs with a view to finding *B. tularense* gave negative results. One of the forms of "lemming fever," a disease contracted from the lemming (*Myodes lemmus*) which migrates in large numbers from the high mountains into the valleys during certain years, closely resembles tularaemia in its clinical aspects. Instances of the occurrence of infections resembling tularaemia in parts of the Russian Union, other than those in which the disease has already been recorded [*R.A.E.*, B, xviii, 63], are reviewed.

Rees (C. W.). **The experimental Transmission of Anaplasmosis by** *Rhipicephalus sanguineus*.—*N. Amer. Vet.*, September 1930, reprint 4 pp. **Experimental Transmission of Bovine Anaplasmosis and Piroplasmosis by Means of an infected Lancet.**—*Op. cit.*, October 1930, reprint 4 pp., 2 charts. Evanston, Ill., 1930.

Anaplasmosis of cattle is prevalent in the United States over an area extending not only beyond the zones within which piroplasmosis (tick fever caused by *Piroplasma bigeminum*) is now confined, but even beyond the range of enzootic bovine piroplasmosis. Though it is probable that both diseases are transmitted by *Boophilus annulatus*, Say, as mixed infections in the area in which it occurs, anaplasmosis has persisted in the absence of this tick, whereas its eradication has been followed by that of piroplasmosis [*cf.* *R.A.E.*, B, xviii, 101]. Other vectors or means of transmission of the disease must therefore be sought [*cf.* xvii, 148].

In the course of an investigation of anaplasmosis carried out in Louisiana, the disease was transmitted to a susceptible animal by means of nymphs of *Rhipicephalus sanguineus*, Latr., engorged as larvae on a clinical case. Observations indicated that whereas larvae and nymphs of *R. sanguineus* engorge readily on cattle, the adults

engorge reluctantly, preferring to attach themselves to a dog or rabbit in such places as the folds of the ear or between the toes. The distribution of *R. sanguineus* precludes the idea that it is the only tick that transmits anaplasmosis outside the range of *B. annulatus* (a one-host tick), and there is evidence that at least two other species may be involved. If anaplasmosis is transmitted by several species of two and three-host ticks, small animals outside the range of the tick control measures at present in use are liable to serve as sources of tick infestation in cattle. The larval and nymphal ticks, which are much more numerous than the adults, are extremely difficult to detect, it being possible for small seed ticks to be present, especially on large animals, in enormous numbers and yet evade the most thorough search. Thus the problem of anaplasmosis will differ widely from that of piroplasmosis, and new measures of control will be necessary.

The experiments described in the second paper show that both anaplasmosis and piroplasmosis may be transmitted from infected to susceptible animals by pricking the skin with a lancet.

SUGIMOTO (M.). **On some Mallophaga from domestic Fowls from China.** [*In Japanese.*]—*J. Soc. Trop. Agric.*, ii, no. 2, pp. 129–134, 2 pls. Taiwan, October 1930. (With a Summary in English.)

Mallophaga obtained in Formosa from fowls imported from Che Kiang (China) were *Goniocotes gallinae*, Retz. (*hologaster*, Nitz.), *Goniodes dissimilis*, Nitz., *Lipeurus caponis*, L. (*variabilis*, Nitz.), *Neumannia pallidulum*, Neum., and *Degeeriella sinensis*, sp. n., which is described.

BUCHNER (P.). **Tier und Pflanze in Symbiose.** [Animals and Plants in Symbiosis.]—8vo, xx+900 pp., 336 figs., 47 pp. refs. Berlin, Gebr. Borntraeger, 2nd edn., 1930. Price, paper, *M*.96.

Some 65 pages of this work are devoted to a summary of the symbionts of blood-sucking Arthropods.

BRIGHENTI (D.). **Ricerche sulla attrazione esercitata dai colori sugli anofeli.**—*Riv. Malariol.*, ix, no. 3, pp. 224–231, 2 figs., 28 refs. Rome, 1930.

Following experiments on the chromotropism of *Anopheles maculipennis*, Mg. [*R.A.E.*, B, xvii, 196], a series of tests has been made under natural conditions in two cattle sheds near Ferrara, the stalls in these buildings being treated with different colour washes. The mosquitos were most attracted by carmine red, violet and yellow, in the order given, and were least numerous in stalls coloured with cobalt blue or dark green. Grey was neutral, being distinctly influenced by the neighbouring colours. White, though somewhat more attractive than blue, gave very variable results. From a total of 43 observations on 129,590 mosquitos, it is concluded that the use of red, violet and yellow in cowsheds and pigsties may increase their effect in diverting Anophelines from dwellings. Blue and green may be used in houses as being less attractive.

De Miglio (U.). **La campagna antimalarica durante l'anno 1929 nel territorio di Crotone (Catanzaro).** [The anti-malarial Campaign in 1929 in the District of Crotone, Catanzaro.]—*Riv. Malariol.*, ix, no. 3, pp. 303–312, 1 map. Rome, 1930.

This is an account of anti-malarial work in 1929, including screening and the use of Paris green against the mosquito larvae, in an area of about 4,500 acres in southern Italy. *Anopheles maculipennis*, Mg., was the predominant Anopheline, but towards the end of October *A. superpictus*, Grassi, appeared and almost replaced it. Though no exact results can be given, it is believed that the work done had a beneficial effect as regards malaria.

Missiroli (A.). **Le grandi bonifiche nei riguardi della biologia e dell' igiene.** [Large-scale Reclamation Work in Relation to Biology and Hygiene.]—*Riv. Malariol.*, ix, suppl., 54 pp., 14 figs., 2 maps, 1 chart, 62 refs. Rome, 1930.

This is a historical survey of the relation between large-scale reclamation work and the biology of *Anopheles maculipennis*, Mg., and malaria, with particular reference to Italy. If, as occurs in large-scale work, the number of stabled animals is increased and the water-surfaces are reduced, the competition between the larvae of the strains of *A. maculipennis* that prefer man or domestic animals, respectively, becomes acute, and the latter strain replaces the former in a short time (15–20 years). If, however, the area contains large expanses of water, this process will be delayed or may not be completed.

de Boer (H. S.). **Anti-Malarial Measures in Towns.**—*Kenya & E. Afr. Med. J.*, vii, no. 9, pp. 256–270, 4 refs. Nairobi, December 1930.

A concise account is given of all measures that may be used for the control of malaria in towns under such conditions as obtain in East Africa, including a discussion of the cost and of the staff necessary for carrying out temporary measures against mosquito larvae.

Leeson (H. S.). **The Dry Season Habits of two Species of *Anopheles* in Southern Rhodesia.**—*Proc. Ent. Soc. London*, v, pt. 2, p. 26. London, 31st December 1930.

Studies of the two Anophelines concerned in the transmission of malaria in Southern Rhodesia showed a decided seasonal adult prevalence of *Anopheles funestus*, Giles, which reached its maximum abundance in February, and *A. gambiae*, Giles (*costalis*, Theo.), which was most numerous in March. Whereas the monthly collections of *A. funestus* diminished gradually during the dry season until December, those of *A. gambiae* dropped rapidly to zero in June and remained so until December, when both species reappeared and subsequently increased in numbers. *A. funestus* was discovered hibernating beneath rocks in dry, but still damp, river beds, most of the females containing almost fully developed eggs, which they deposit in August when the temperature rises in the neighbourhood of marshy ground and riverside puddles. After this they die and few adults are found in December,

although many young larvae occur in the breeding-places and the new generation emerges in January. *A. gambiae* was entirely absent in these breeding-places and other possible haunts examined, but was finally discovered at much lower altitudes, being probably unable to withstand the low temperatures prevailing above 1,900 ft. Larvae were collected at 1,500 ft., and larvae pupae and adults became abundant below 1,300 ft. The reappearance of this species at 3,600 ft. in December is thought to be due to the seasonal rise in temperature.

HOPKINS (G. H. E.). **Report of the Medical Entomologist.**—*Ann. Rep. Lab. Serv. Div. Uganda 1929*, pp. 17–21. Entebbe, 1930.

The mosquito survey of Kampala was continued and extended, much of the information contained in this report being similar to that already noticed [*R.A.E.*, B, xviii, 241]. In view of the various forms of filariasis that occur in Kampala, records of Culicines found in houses are of considerable importance. The commonest species were *Aëdes argenteus*, Poir., and *Culex* (?) *pipiens*, L. ; *Mansonia* (*Taeniorhynchus*) *fuscopennata*, Theo., *Aëdes lineatopennis*, Ludl., and unidentified Culicines were observed in small numbers. No Anopheline has yet been found breeding in tree-holes, barrels, plant axils or rainwater tanks, but *Aëdes argenteus* almost invariably breeds in tanks and barrels that are inadequately screened, and very frequently in tree-holes. Several other species of *Aëdes*, including *A. africanus*, Theo., are commonly found in tree-holes and occasionally in barrels, and *A. simpsoni*, Theo., is abundant in the axils of *Colocasia* and *Dracaena* ; no other species of mosquito has yet been found in the axils of plants. Both *A. africanus* and *A. simpsoni* are experimental vectors of yellow fever. Observations in an undrained swampy area of natural forest indicate the absence of Anophelines other than *Anopheles implexus*, Theo., and *A. obscurus*, Grünb., neither of which is very common or at present implicated in the transmission of malaria.

GIBBINS (E. G.). **Report by the Laboratory Assistant.**—*Ann. Rep. Lab. Serv. Div. Uganda 1929*, pp. 21–25. Entebbe, 1930.

The total number of mosquitos caught in native huts in selected localities in Uganda during the period from May to December and identified was 15,674, of which 9,078 alimentary tracts and 8,512 salivary glands were dissected and examined. The monthly percentage of malaria infection in *Anopheles gambiae*, Giles, varied from 14·4 to 24·9, in *A. funestus*, Giles, from 13·1 to 17·7, and in *A. theileri*, Edw., from 0 to 10·9. In one European house, four females of *A. gambiae* were caught in eight months. In one an oöcyst was found in the stomach, and in another sporozoites were numerous in the salivary glands. It has been found that mixed infections occur in the same mosquito, and that the three species are carriers of all three forms of malaria. Culicines greatly outnumbered Anophelines in one locality, and one out of 22 females of *Culex* dissected showed a sheathed microfilaria in the gut. Microfilariae were found in *A. gambiae*, once in the stomach and 6 times in the thorax, in *A. theileri*, twice in the stomach and twice in the thorax, and in *A. funestus*, 6 times in the thorax. Other parasites found in these three Anophelines are also recorded.

Longo (D.). **La malaria in Tripolitania. (Note clinico-epidemiologiche.)** —*Arch. ital. Sci. med. colon.*, xi, no. 7, pp. 418–428, 1 map. Tripoli, 1st July 1930. (With a Summary in English.) (Abstract in *Trop. Dis. Bull.*, xxviii, no. 2, p. 113. London, February 1931.)

A map is given showing the principal towns and the degree of infestation with malaria. The chief malarial district is along the coast. The Anophelines found are *Anopheles algeriensis*, Theo., and *A. mauritianus*, Grp.

Hamlyn-Harris (R.). **The Consideration of certain Factors as Potentialities in Mosquito Control in Australia.**—*Proc. R. Soc. Queensland*, xlii, no. 10, pp. 86–105, 2 pls., 6 figs., 8 graphs, 25 refs. Brisbane, 13th November 1930.

An account is given of laboratory experiments and field observations carried out in Queensland on factors influencing the breeding of mosquitos.

The following is taken largely from the author's summary and conclusions: Under ideal conditions mosquitos tend to breed in waters best suited to their particular requirements, suitable food being the primary influence in selection. Liability to subsequent alteration of the waters, due to decomposition or other causes, does not necessarily affect the choice of breeding-place, for eggs are frequently laid on waters that ultimately prove to be toxic. Decomposition products are of great importance in determining the duration of the developmental stages of mosquito larvae and the length of their survival. It would seem that the presence of albuminoid ammonia ensures a plentiful food-supply and renders water particularly attractive to *Culex fatigans*, Wied. It was found that larvae can survive for an abnormal length of time without atmospheric oxygen and, as oxygen is known to be essential to their existence, it is suggested that they are capable of making use of the oxygen dissolved in the water. Hydrogen-ion concentration was found to vary with the temperature. Characeae exert no lethal effect on larvae in the field, *Anopheles annulipes*, Wlk., and *Culex annulirostris*, Skuse, being found in large numbers in pools containing thick growths of *Chara* spp. and *Nitella* spp. In the laboratory, larvae hatching from eggs of mosquitos placed in a jar containing *Nitella phauloteles* failed to mature, but larvae of *C. fatigans* given fish food every third day thrived, thus showing that *N. phauloteles* is not lethal to mosquitos under normal conditions provided that the food-supply is adequate. The waters of rice-fields, though suitable for breeding, are not selected at the beginning of the season, but when the mosquitos are deprived of the water in drainage ditches and other permanent breeding grounds, they colonise the rice-fields anew each year. Control measures should therefore be directed against the larvae in the permanent breeding-places.

Jackson (R. B.). **Malaria and Mosquito Curtains in certain Areas of Pahang West.**—*Malayan Med. J.*, v, no. 2, pp. 67–68. Singapore, June 1930.

A malaria survey in three districts in Pahang West showed that malaria was practically non-existent in areas inhabited by Chinese

in spite of the presence of large numbers of larvae of *Anopheles maculatus*, Theo., and other Anophelines in proximity to dwellings, whereas the spleen rates in districts inhabited by Malays and Tamils respectively were 69 and 79 per cent. The absence of malaria among the Chinese is attributed to their habitual use of mosquito nets.

WALLACE (R. B.). **Cessation of Oiling in a malarious Area during a certain Season of the Year.**—*Malayan Med. J.*, v, no. 4, pp. 117–125. Singapore, December 1930.

Oiling was stopped experimentally on two divisions of each of two estates in Malaya [*cf. R.A.E.*, B, xviii, 58] from 14th October till 31st December 1929. Although there was a subsequent increase in the number of breeding-places of *Anopheles maculatus*, Theo., and in the number of adults caught, the malaria rate showed a fall, the divisions with no oiling giving the lowest rate on the more malarious of the two estates. It is therefore concluded that there is a certain period of the year, following the usual malarial season which lasts approximately from March till September, when *A. maculatus* either does not cause infection, or its pathogenicity or susceptibility is at its lowest, and when larvicidal measures would appear to be unnecessary.

The numbers of breeding-places of the 12 species of Anophelines present on the estates located in each month of 1929 and the monthly catches of adults are shown in tables.

GATER (B. A. R.). **The Asthenobiosis Theory and Larval Surveys.**—*Malayan Med. J.*, v, no. 4, pp. 126–128, 1 fig. Singapore, December 1930.

Taking into account Roubaud's theory of the inverse density of larval and adult Anophelines [*R.A.E.*, B, xi, 162], and the consequent danger of drawing false conclusions exclusively from larval surveys, the data obtained by various workers are examined with a view to ascertaining whether inverse density exists in Malaya. Figures relative to catches of larval and adult Anophelines obtained over a period of nine months in the same rice-field area in 1926 and 1927 [xvii, 12, 13] showed that although *Anopheles aconitus*, Dön., would have been pronounced absent in September and October as a result of larval surveys alone, adults were present and the maximum densities of larvae and adults did not coincide. In the same area in 1929, large numbers of larvae of *A. maculatus*, Theo., were found in the near vicinity of houses and traps in which adults were taken in very small numbers or not at all. Another case in which large numbers of Anopheline larvae were found without a correspondingly high incidence of malaria is recorded from a village inhabited by Chinese in Pahang [xix, 70], the suggestion that the immunity of the inhabitants was due to the use of the mosquito net being probably inadequate.

From a comparison of the figures given for the adults of *A. maculatus* caught and the breeding-places found each month by Wallace [see preceding paper], the author concludes that large adult catches were concurrent with small numbers of larvae and the reverse and therefore that anti-malaria work may possibly be stopped without an increase of malaria in spite of a considerable increase in the number of breeding-

places, the number of adults found being proportionately much smaller than would have been expected. Sufficient data have been given to cast some doubt on the validity of purely larval surveys, especially when they are not continued throughout the year. It appears possible to pronounce a district free from *A. maculatus* when it is actually present in some numbers, and on the other hand to incur expenditure when it is unnecessary. Adult trapping should therefore become a matter of routine in surveys, at least until the inaccuracy of the theory here outlined has been proved by experimental test on a large scale.

PURI (I. M.). **Synoptic Tables for the Identification of the full-grown Larvae of the Indian Anopheline Mosquitoes.**—*Health Bull.*, no. 16 (*Malaria Bur.*, no. 7), 65 pp., 79 figs. Calcutta, Govt. India Centr. Pub. Br., 1930. Price 8*d.*

The author gives a detailed description of the external characters of Anopheline larvae, with notes on methods of examining, fixing, preserving and mounting specimens, followed by two keys for their identification. In the first key no varieties are dealt with, and identification is based on very simple characters, supplementary ones being given only where confusion is likely to occur. In the second the larvae of all the Indian Anophelines are included, and supplementary characters are given wherever possible. A list is also given of the species occurring in India, showing their commonest breeding-places and giving roughly their distribution.

CLEMESHA (W. W.) & MOORE (J. H.). **Five Years' Anti-malaria Measures on the Travancore Tea Companies' Estates.**—*Ind. Med. Gaz.*, lxv, no. 12, pp. 671–683. Calcutta, December 1930.

An account is given of a successful anti-malaria campaign carried out on various tea estates in the Periyar Valley, Travancore. This valley is particularly unhealthy, owing to the fact that a large dam above the estates prevents the river from being flushed for a number of months in the year. Consequently, it consists of a chain of pools over a rocky bed with a very slight current and forms a favourable breeding-place for *Anopheles culicifacies*, Giles, which transmits most of the malaria at the bottom of the valley, and for *A. listoni*, List., *A. aconitus*, Dön., and *A. karwari*, James, which were found more or less plentifully. Large numbers of *A. maculatus*, Theo., and *A. listoni*, which are both known vectors of malaria, and a few *A. aconitus* breed in the hill streams and small seepage areas. Cases of the disease usually begin at the end of March and increase in numbers and virulence until the onset of the monsoon rains in the early part of June. Anopheline larvae begin to be common in the smaller, more sheltered breeding-places in the third or fourth week in February, but are seldom found in the Periyar river in any numbers until the end of March or beginning of April.

The authors emphasise the importance of the proper timing of anti-malaria measures, so that the Anopheline population will never increase beyond the normal winter level. During the winter months of December and January the dwellings of Europeans, staff, etc., are cleaned and whitewashed and sometimes fumigated with sulphur. This has prevented the outbreaks of malaria due to hibernating infected female Anophelines, which occasionally occurred in

the first week in March [*cf.* *R.A.E.*, B, xviii, 29]. During February anti-gametocyte treatment is given to both adults and children. On 1st March, or earlier if larvae are caught before, vigorous anti-larval measures are undertaken, oiling being carried out weekly throughout the dry season.

Results show the efficacy of plasmochin compound in removing gametocytes from the blood and preventing relapses, and the great influence that this gametocyte-removal, when carried out systematically, has on the incidence of the disease in any community. In 1930, malaria practically ceased to exist, and the regular prophylactic dosing of all children was discontinued. Euquinine and sweetened condensed milk, with or without a little plasmochin, was found to be the best treatment for removing gametocytes from the blood of children.

RAO (K. R.). **Note on the Present State of Knowledge about Malaria in the Presidency of Madras.**—*Rec. Malaria Surv. India*, i, no. 4, pp. 473–497. Calcutta, December 1930.

An account is given of malaria investigations carried out in 31 areas in different parts of the Madras Presidency between August 1927 and March 1929, and subsequently in a further 9 areas. Details are given of the conditions in each type of area, with tables showing the Anophelines found, their breeding-places, and the spleen and parasite rates. Malaria is prevalent to a variable extent in almost all the districts of the Presidency, which are divided into four different regional groups. In hilly tracts or plateaux at altitudes varying from 2,500 to 5,500 ft., its incidence generally begins in the first quarter of the year and attains a maximum only in the second, when the breeding of *Anopheles maculatus*, Theo., in the ravine streams and seepage channels is also at its maximum. The fever season comes to an abrupt end when the rains of the south-west monsoon begin, between May and June, but breaks out again in the pre-monsoon months in the following year. In the Agency parts, however, which also come under the influence of the south-west monsoons, the showers of June start a sharp outbreak in July and another occurs in October, following the few showers of the north-east monsoon when *A. culicifacies*, Giles, is found breeding in large numbers. Malaria seems to be always present, however, and infection is contracted throughout the whole year. More than one species of *Anopheles* appear to be vectors. Altitudes of 2,500–3,500 ft. seem to provide a mean annual temperature of 60–65° F. and a mean relative humidity of 60–70, and these are optimum conditions for the propagation of the Anophelines and the development of the malaria parasite in both mosquito and man. Malaria is therefore hyperendemic in the majority of such stations. Malaria occurs in varying degrees of severity in the submontane regions, and the extent of endemicity in the villages is in inverse ratio to their proximity to the hills. In a representative locality of this group, fevers generally prevail between February and April and are due to hill streams and seepage channels in which *A. maculatus* and *A. listoni*, List., preponderate over other and less dangerous species. In the inland tracts, which include large rural areas and bigger municipal towns, the problem is mostly associated with irrigation channels and wet cultivation. Agricultural operations are neither properly controlled nor sufficiently regulated, so that irrigation channels and the adjacent pools are so overgrown with weeds that the free flow of

water is obstructed and *A. culicifacies*, practically the sole vector in this region, is able to breed prolifically. The proximity of rivers to villages and towns is of no consequence except where they flow in rocky beds. The fourth region is the coastal line, where malaria is limited to a narrow belt of country on the east coast, north of Madras, where it is very common. No investigation has been carried out over the greater part of this tract, where *A. minimus* var. *varuna*, Iyengar, is found breeding generally, especially in wells, without, however, appearing to play a significant part in the transmission of the disease. Excavation of pits and holes in the ground and neglect of irrigation sources and channels are almost wholly responsible for the continual recrudescence of malaria in this region. The absence of the disease in the delta tracts of Tanjore and Trichinopoly in the south and Kistna and Godavari in the north is significant. Here considerable flooding with muddy water occurs, with an annual mean temperature of 85° F. or more and a mean relative humidity of 85 or 90, but other possible factors are not yet known.

Preventive measures, which are mainly concerned with the destruction of the breeding grounds of *A. culicifacies*, the predominating carrier of malaria throughout Madras, are briefly discussed, and a short account is given of the actual work done in this direction.

CHALAM (B. S.). **Further Observations on Paris Green as an *Anopheles* Larvicide.**—*Rec. Malaria Surv. India*, i, no. 4, pp. 515–522, 1 pl., 4 refs. Calcutta, December 1930.

From a review of recent work and observations carried out with Paris green against Anopheline larvae, it is concluded that this material fulfils the requirements of a larvicide better than any other known preparation, its advantages far outweighing its limitations. It is a selective poison, affecting only the surface-feeding Anophelines, and can be used extensively for work in all seasons. It is specially suitable for areas covered by vegetation and in impounded water collections, and its use is harmless when comparatively simple precautions are taken. Two kinds of blowers for the distribution of Paris green are described, one a light type with a capacity of 20 lb. that can be operated by one man, and the other consisting of a geared fan actuated by hand and giving a very strong blast, the capacity of which is 40–60 lb. The second type, which has a much greater spreading power, can be used with a barrow or litter carried by two men. A light breeze up to 6 miles an hour is best suited for the distribution of Paris green mixture, the greatest distance that the dust can reach being about 180 ft. in the case of the large blower and 110 ft. in the case of the small one. Almost complete destruction of the larvae may be obtained in open areas with little or no vegetation up to 50 ft. from the small blower and 80 ft. from the large one by using a 1 per cent. Paris green and soapstone mixture. The percentage of larvae killed then gradually decreases as the distance increases. Comparative tests of varying dilutions of Paris green show that it is more advantageous to use 2½ units of a 1 per cent. mixture than one unit of a 5 per cent. mixture at the same cost, since the effect is decidedly greater and is almost equal to one unit of a 1 per cent. mixture used 5 times. Provided that enough of the mixture is distributed, the dust will penetrate covering vegetation in quantities sufficient for larval destruction, but if the foliage is wet, or if there is considerable wind-drift, it is inadvisable

to carry out dusting operations. In the case of rice-fields 1 lb. Paris green to the acre is a safe margin for treatment, and about 2 lb. to the acre was found adequate in areas covered thickly with water hyacinth.

Covell (G.) & Baily (J. D.). **Malaria in Sind. Part I. Malaria in the Guni Division of Hyderabad District (Fuleli Canal Area). Part II. Malaria in the Mirpur Khas Division of Thar and Parkar District (Jamrao Canal Area). Part III. The Factors influencing the normal autumnal Incidence of Malaria in Larkana Taluka, Larkana District.**—*Rec. Malaria Surv. India*, i, no. 4, pp. 523–565, 3 charts, 1 map, 1 fldg. table, 31 refs. Calcutta, December 1930.

Detailed reports are given of malaria surveys carried out in three districts of Sind, a preliminary account of which has already been noticed [*R.A.E.*, B, xix, 43]. It is concluded from the survey of the Guni Division that villages and towns in the centre of wet cultivation are invariably malarious. Where there is no wet cultivation, villages may be either malarious or comparatively healthy according to the presence or absence of suitable breeding-places for *Anopheles culicifacies*, Giles, which is the chief, if not the sole vector of the disease. Other common species present are *A. subpictus*, Grassi, and *A. pulcherrimus*, Theo. ; *A. stephensi*, List., and *A. fuliginosus*, Giles, occur rarely. Very large numbers of Anophelines were dissected in various parts of Sind, and *A. culicifacies* was the only species found with sporozoites in the salivary glands. The annual influx of labourers from the desert areas of Thar and Parkar district at the beginning of the malaria season probably plays some part in the incidence of the disease in this district. Epidemics do not occur in Lower Sind with anything approaching the intensity that they exhibit in the northern part of the Province. Factors in the production of such epidemics as do occur are high and late flood levels, excessive rainfall, and famine in adjacent territories, which causes an influx of refugees. Hyperendemic malaria existing in the Larkana district is only slightly affected by the epidemics of fulminant malaria that occur in the less profusely irrigated areas of Upper Sind. The malaria season during the period of observation lasted from September to December. The period of maximum prevalence of *A. culicifacies* coincides with this season, and salivary gland infections were encountered during the same period. The fact that a high percentage of gut infections, but no gland infections, were found during January–April, after the termination of the malaria season, can be adequately explained by the occurrence during this period of unfavourable meteorological conditions leading to a retardation of development of the malaria parasites coupled with a shortening of the life of the mosquito. In this area, a mean monthly temperature of 90° F. and over appears to induce a condition of aestivation in *A. culicifacies*, during which oviposition is in abeyance. This would explain the fact that no larvae of this species were encountered at the end of August, although breeding-places, apparently favourable, were present in abundance previous to this date. If these conclusions are correct, there may be said to be a period during which infection does not take place in this area, lasting approximately from January to August except for a short period in February when infections may possibly occur. The chief factors concerned in the incidence of malaria in the Larkana area are favourable temperature,

humidity and breeding-places for *A. culicifacies,* which are aided by the general flooding of the country-side by inundation irrigation, the high sub-soil water level, the proximity of the Indus, and the system of rice cultivation practised. Rainfall is usually too scanty to have any effect, but when it occurs in excess during the month of August, it appears to favour the spread of the disease.

RAMSAY (G. C.). **The Malaria Problem of Assam.**—*J. Trop. Med. Hyg.*, xxxiii, no. 23, pp. 352–357, 2 figs., 4 refs. London, 1st December 1930.

As a result of recent research on the problem of malaria in Assam, *Anopheles minimus,* Theo., has been found to be the most important vector [*cf. R.A.E.*, B, xviii, 171 ; xix, 48]. In selecting its breeding-places, this species avoids muddy or silty water, water contaminated with the products of iron oxide bacteria or covered with a thick scum of surface algae, or water with a rapid current or covered with dense shade [xviii, 172]. Larvae have recently been found in a concrete well, left undisturbed for several weeks, but were eliminated by providing a suitable cover which excluded the light. Larvae are not generally found in wells, as these are usually treated daily with chlorogen, which eliminates the food supply ; even in open unchlorinated wells they do not usually survive, owing to constant disturbance of the water. This finding shows that larvae will breed in open concrete drains if these are not graded to prevent the formation of pools and allow a high velocity of current (in the author's opinion the gradient should not be less than 1 in 200). In certain highly malarious sites, the breeding of *A. minimus* should be eliminated by shading water with trees that will give a dense shade throughout the malaria season.

RAMSAY (G. C.) & FRASER (G.). **Notes on Silt and Shade in the Control of Malaria in Assam, with a Preface by Sir Malcolm Watson.**—8 pp., 10 figs. London, Ross Inst. Hosp. Trop. Dis. [1931.]

Anti-mosquito measures for the control of malaria in Assam are directed almost entirely against *Anopheles minimus,* Theo. [see preceding paper]. This species will not breed in low-lying areas flooded by water with silt or clay in suspension, whereas small depressions carrying clear water running only during rains are conducive to intense malaria. Moreover, breeding does not occur in dense shade, and control has been obtained by establishing rapidly growing plants that give thick shade along certain types of streams, and various canes to provide suitable covering shade in swamps. Certain types of bridges create swamps by preventing the natural flow of water. As malaria control is being extended to other estates in Assam and Bengal, this brochure, which consists chiefly of photographs with explanatory notes, has been issued to illustrate what is required for the above-mentioned measures of control.

GODOY (A.), LOBO (A.) & CRUZ filho (O.). **Sur les anophélinés qui transmettent le paludisme au Brésil.**—*C.R. Soc. Biol.*, cv, no. 34, p. 731. Paris, 12th December 1930.

In view of the uncertainty of the classification of some of the Anophelines of Brazil, which was revised by Root and confirmed by the work of da Costa Lima [*R.A.E.*, B, xiv, 197 ; xvii, 85, etc.], it became

necessary to determine the part played by the various species in the transmission of malaria. Observations on the vectors by various workers [*R.A.E.*, B, x, 175; xi, 201; xv, 23, etc.] may be taken as fairly correct, except that where they indicate *Anopheles argyritarsis*, R.-D., the species concerned is probably *A. albitarsis*, Arrib., and the species given by them as *A. albimanus*, Wied., is probably *A. bachmanni*, Petrocchi, or *A. strodei*, Root. It was nevertheless decided to carry out experimental infection with various Anophelines and to examine any found naturally infected. The evolution of the parasite of benign tertian malaria [*Plasmodium vivax*] has been obtained experimentally in *A. tarsimaculatus*, Goeldi, up to the phase of sporozoites in the salivary glands. At the end of May *A. albitarsis* was found in nature with a large number of sporozoites in the salivary glands. Examination over a period of 6 months of Anophelines found in houses inhabited by malaria cases showed that no infected mosquitos occur until there is a definite drop in the temperature. This confirms the observations of Boyd, who found infected Anophelines only in March and April.

ROUBAUD (E.) & TOUMANOFF (C.). **Essais d'infection expérimentale de larves de culicides par quelques champignons entomophytes.**—*Bull. Soc. Path. exot.*, xxiii, no. 10, pp. 1025–1027, 1 fig. Paris, 1930.

From the experiments described it appears that, although larvae of *Culex pipiens*, L., are susceptible to infection by *Beauveria bassiana* and those of *Anopheles maculipennis*, Mg., to infection by *B. bassiana* and *B. globulifera*, only a certain number actually become infected and die, and the use of these entomogenous fungi for the destruction of larvae would not therefore appear to be of any practical value in the field. Attempts to infect larvae of *C. pipiens* with spores of *Aspergillus flavus* gave negative results.

KHALIL (M.). **Introduction du poisson** *Gambusia affinis* **en Égypte, dans le Soudan anglo-égyptien, à Chypre et en Syrie pour combattre le paludisme.**—*Ann. Paras. hum. comp.*, viii, no. 6, pp. 593–597. Paris, 1st December 1930.

The author describes the introduction of *Gambusia affinis* from Corsica into Egypt for the purpose of controlling malaria mosquitos. This fish is more valuable than *Tilapia nilotica*, which lives in fresh water, and *Cyprinidon* sp., which lives in salt water, both on account of its preference for mosquito larvae as food and also because it can live in either fresh or salt water. It multiplies rapidly in Egypt, where it has been widely distributed, and it is particularly successful in covered collections of water. From Egypt consignments of the fish have been sent to Cyprus, the Sudan and Syria.

BELITZER (A.) & MARKOFF (A.). **L'agent vecteur de la piroplasmose canine dans les régions centrales de l'U.R.S.S. (Russie).**—*Ann. Paras. hum. comp.*, viii, no. 6, pp. 598–601, 15 refs. Paris, 1st December 1930.

The vector of *Piroplasma canis* in the Russian Union, where canine piroplasmosis is of widespread occurrence, has never been determined.

The authors' experiments were carried out with ticks reared from eggs laid by females of *Dermacentor reticulatus*, F., that had been taken from infected dogs in Omsk. The larvae and nymphs did not feed readily on dogs and did not transmit the disease, but dogs were infected by adults that had been fed as nymphs and larvae on mice. The reluctance of the immature ticks to attach themselves to dogs indicates that under natural conditions they feed only on small mammals [*cf.* *R.A.E.*, B, xvii, 201]. It therefore appears that *D. reticulatus* is the vector of canine piroplasmosis in the north and centre of the Russian Union, but in the south some other tick is probably concerned.

Harris (R. H. T. P.). **Report on the Trapping of Tsetse Flies.**—Fol., 8 pp., 4 figs. Pietermaritzburg, Natal Witness Ltd., 1930.

In this paper, the author gives specifications and plans for the construction of the trap for use in the control of *Glossina pallidipes*, Aust., in Zululand, mentioned in a previous report [*R.A.E.*, B, xix, 14]. The form of the trap is primarily based upon the response of the fly to conspicuous objects of compact bulk and distinct outline, showing tonal contrast to their surroundings [*cf.* *R.A.E.*, B, xvi, 129]. A compact bulk was found to attract more flies if extended in a horizontal rather than a vertical direction. Moreover, it has been observed that when attacking a live animal, the fly most frequently dives to the lower edge of the object, as constituted by the legs and belly, and it is believed that this action is due to a direct response to the attraction of the shadow thrown by the superimposed bulk.

The trap consists essentially of a wooden framework 6 ft. long, triangular in vertical section, with the apex downwards. The rectangular top (or base of the triangle) is 3 ft. wide and made of wood with a slit in the middle, over which is placed a wire gauze fly trap. The sides and ends of the trap are covered with double buff-coloured hessian, as the fly appeared to enter such a trap more readily than one covered with material of another colour. The fly, attracted to the lower edge of the trap, enters through a narrow slit (3 ins. wide extending the entire length of the trap) into the hollow interior and is then attracted from the dark inside to the slit in the roof and so into the wire-gauze cage. There is no bait or inducement to enter the trap other than the fly's response to visual stimuli.

The most suitable places for the erection of traps are those that are naturally attractive to animals for shelter, grazing and proximity to water. If the shelter happens to consist of an evergreen plant community, there is a greater tendency for it to become a permanent habitat of the fly than if it is composed of deciduous bush. Traps erected in such a situation daily remove large numbers of fly, which are continually being attracted to that situation. The traps, which are suspended by wires from two wooden uprights, should not be placed amongst the conflicting shadows of the surrounding foliage. The north side of a patch of bush has so far been found the most satisfactory situation. High wind, rain and cold, overcast days are unfavourable for large catches. Where the grass has been cleared, the trap should be suspended about 18–24 ins. above the ground, but when large numbers of traps are being erected they may be hung 18–24 ins. above the top of the grass, due allowance being made for further growth

of the latter. It is estimated that the cost of the trap is about 32*s*. 6*d*. Although this might be reduced by employing cheaper materials, the ultimate cost would probably be greater owing to the need of repairs and replacements, and the more constant supervision required.

CONNAL (A.). **Annual Report of the Medical Research Institute, 1929.** —*Ann. Med. Sanit. Rep. Nigeria 1929*, Appx. A, pp. 5–30, 3 charts. Lagos, 1930.

Further information on fleas and rat plague and on mosquitos in Nigeria is given on the lines indicated in the last report [*cf. R.A.E.*, B, xviii, 201]. In dissections of Anophelines found in houses, eight individuals of *Anopheles gambiae*, Giles, showed filarial infections, two showed sporozoites in the salivary glands and two oöcysts on the walls of the stomach ; one individual of *A. pharoensis*, Theo., also showed oöcysts on the walls of the stomach.

It was previously found that if a mosquito was fed on drawn blood or sugar water, the blood or sugar did not go into the stomach but into the ventral diverticulum. As it was desired to feed mosquitos on malarial cultures, experiments, which were inconclusive, were carried out to find out in what way a mosquito could be induced to take the food presented directly into its stomach.

LESTER (H. M. O.). **Report of Tsetse Investigation, 1929.**—*Ann. Med. Sanit. Rep. Nigeria 1929*, Appx. B, pp. 33–49. Lagos, 1930.

Experimental clearing for the elimination of the main foci of *Glossina morsitans*, Westw., and *G. tachinoides*, Westw., was continued [*R.A.E.*, B, xviii, 202]. In general the policy of not cutting the savannah has been maintained, but in certain parts the heavier patches have been cleared to afford contrast to similar areas that have been conserved. In one place, very heavy forest with much thicket was cleared, leaving a large number of the finer trees in an attempt to make the area into good savannah woodland. Recent inspection showed that where the slash was thick the trees had been severely injured by fire, but elsewhere the damage was negligible and as a whole the area was tending to be invaded by grass. In fringing bush, clearing was attempted by cutting only the thicket and the lower branches of the trees, the trees themselves being " sapped " by encircling the trunk with a ring of overlapping slashes. Recent inspection indicates the probability of excellent results, as most of the trees weakened by sapping have succumbed to fire, and the present herbaceous growth has a tendency to smother any surviving arboreal re-growth. The immediate effect on tsetse-fly was equal to that of complete clearing, with the exception that one of the most prevalent and troublesome riverine trees, *Mitragyne africana*, is so deeply creviced that it is not susceptible to sapping in many cases.

When a clearing was extended to only 300 yds., the numbers of *G. tachinoides* invading it during the wet season spread were very much reduced, and when the clearing was extended to 800 yds., they became almost negligible. These results confirm those obtained in the previous year, but it was also found that if a suitable area of thicket of a secondary focus is left in a clearing, which may extend for a distance

of 3,000 yds., the wandering wet season flies are sufficient to repopulate it fully. The numbers of *G. morsitans* invading the good savannah woodland left in the general clearings during the wet season spread were not reduced from normal (70 per boy-hour approximately) when a clearing of the neighbouring primary focus was extended to 800 yds., but, when the clearing was extended to 2,500 yds., there was a material reduction ; thus, in two cases, the reduction was from 68 per boy-hour to 16 and from 77 to 27. The extension of the clearings to 7,000 yds. did not bring about a corresponding reduction, for in the wet season spread a density of 10 per boy-hour was obtained in these areas, showing that *G. morsitans* spreads at least 4 miles from its primary foci in the wet season.

It is suggested that this failure to control *G. morsitans* in proportion to the extension of the clearing may be partly due to the increase of antelope and pig in the cleared areas, where they appear to find more respite from the attacks of the fly. If the clearings were farmed, their extension in this area would be justified, as the driving off of the game would open up the fertile parts for cattle, but as only a few settlers have arrived, the clearing will not be further extended.

Although deferred grass-burning undertaken at the end of February certainly reduced the numbers of *G. morsitans* in the conserved portions of the savannah woodlands, experience during four years has shown that under local conditions the results obtained do not justify the expense involved, and no further experiments in delayed grass-burning will be carried out.

Summaries are given of various papers on tsetse investigation that have already been noticed [*R.A.E.*, B, xviii, 172 ; xix, 12, 59].

Potts (W. H.). **A Contribution to the Study of Numbers of Tsetse Fly** (*Glossina morsitans* **Westw.**) **by Quantitative Methods.**—*S. Afr. J. Sci.*, xxvii, pp. 491–497, 11 refs. Johannesburg, November 1930.

The history of the development of the methods used in the study of the prevalence and distribution of *Glossina morsitans*, Westw., in Tanganyika Territory, and the reasons for their adoption are discussed. The original " fly rounds " developed into two new methods, extended reconnaissance fly rounds, which cover large stretches of country at regular intervals [*cf. R.A.E.*, B, xviii, 240 ; xix, 61], and ecological fly catches, which are described in detail in this paper. The following is taken from the author's conclusions : It is considered that the ecological fly catches will give data representing the response of the fly to the variable factors within the environmental complex, these factors being daily and seasonal changes in the floral community, in the faunal community, in the fly itself and in the physical factors. This interpretation of the factors will be permissible because the time of day at which the catches are made (with certain reservations), the duration of the catch, the area covered, and the number of persons engaged in the catches are all constant. The factors affecting adversely the accuracy of the interpretations are the elusiveness of the fly (enabling it to avoid capture), human factors, and the difference in the time of day at which catches are carried out (in comparing one station with another).

[DE] SOUSA NÁPOLES [F. M.]. **Distribuïção geográfica das glossinas em Moçambique. Compilação dos trabalhos de reconhecimento realizados pela Delegação de Sanidade Pecuária do distrito, de 1921 a 1929.** [The geographical Distribution of *Glossina* in Mozambique. A Compilation of the Surveys made by the Regional Cattle Commission from 1921 to 1929.]—*Bol. agric.-pecuário*, 1930, no. 1–2, pp. 87–100. Lourenço Marques, 1930.

In this series of annotated records of tsetse-flies in Mozambique, there is no indication of the species of *Glossina* concerned.

CORSON (J. F.). **Observations on** *Trypanosoma rhodesiense* **in Sheep and Goats.**—*J. Trop. Med. Hyg.*, xxxiii, no. 24, pp. 385–389. London, 15th December 1930.

It is possible that sheep and goats may be temporary sources of infection in sleeping sickness areas, and experiments were therefore carried out in Tanganyika Territory to determine the effect on *Trypanosoma rhodesiense* of maintenance by continued direct transmission in these animals, which must frequently become infected in nature.

The following is the author's summary: The characters by which *T. rhodesiense* is distinguished from *T. gambiense*, such as high infectivity and virulence for laboratory animals, rapid multiplication and the occurrence of numerous post-nuclear forms in the blood of these animals, were preserved by the trypanosome during maintenance for six months in sheep and goats. The trypanosomes showed also, on the whole, a somewhat greater susceptibility to the action of normal human serum, when tested in subinoculated white rats, than was shown when rats were directly infected from man. So far as can be judged from these direct passage experiments, a herd of sheep and goats can remain infected with *T. rhodesiense* for at least several months and possibly throughout its existence as a herd, where opportunities occur for the transmission of the infection. The animals are infective throughout the course of the disease, which is short and acute.

DIAS (E.). **Da presença de formas de evolução do** *Trypanosoma cruzi* **Chagas, nos tubos de Malpighi do barbeiro.** [On the Presence of evolutional Forms of *T. cruzi* in the Malpighian Tubes of *Triatoma megista*.]—*Mem. Inst. Oswaldo Cruz*, xxiv, fasc. 3, pp. 183–185, 3 pls. Rio de Janeiro, 1930.

The Malpighian tubes of adults of *Triatoma megista*, Burm., the chief natural vector of Chagas' disease in Brazil, have been found to contain evolutional forms of *Trypanosoma cruzi*, which are probably a phase of active multiplication of the trypanosome.

ARISTARKHOVA (O.). **Observations sur la peste endémique en Russie.**—*Bull. Soc. Path. exot.*, xxiii, no. 9, pp. 901–904, 3 refs. Paris, 1930.

Laboratory experiments and field observations carried out in Astrakhan in 1913–14, showed that *Neopsylla setosa*, Wagn., which is one of the commonest fleas on *Citellus* in this region, will bite man and is capable of transmitting bubonic plague.

BOUFFARD (G.). **La trypanosomiase humaine en Côte d'Ivoire.**—*Bull. Soc. Path. exot.*, xxiii, no. 9, pp. 922–927. Paris, 1930.

After describing two cases of sleeping sickness in Europeans, contracted recently in the Ivory Coast, the author points out the rarity of the disease in this region and discusses various explanations for this phenomenon, all of which appear to be unsatisfactory, with the possible exception of the hypothesis that the primary reservoir of *Trypanosoma gambiense* is a wild animal, and that in this area man is of little or no importance in the preservation of the virus.

ROUBAUD (E.) & TOUMANOFF (C.). **Intoxications d'encombrement chez les larves de *Culex* vivant en milieu non renouvelé.**—*Bull. Soc. Path. exot.*, xxiii, no. 9, pp. 978–986, 3 refs. Paris, 1930.

The author describes experiments with *Culex pipiens*, L., which show that in a small collection of water, the development of the larvae may be hindered or modified considerably by the accumulation of their excreta. When the layer of excreta at the bottom of the water is thin, a marked retardation of development takes place during the fourth stage; when it is thicker, a heavy mortality occurs in this stage. The higher the temperature, the greater the toxic effect. When the toxic action is slow and weak, some of the larvae have been observed to resume their development, slowly recovering from the toxic effects as the excreta of their dead companions is gradually destroyed through the action of micro-organisms. It is generally males that survive. The subjection of poisoned larvae for a long period to a low temperature is the surest means of reactivating them and enabling them to continue their development. These phenomena of arrested development are directly comparable with the phenomena of natural diapause and reactivation during the winter.

SCHWETZ (J.). **Sur quelques diptères hématophages du Congo.**—*Bull. Soc. Path. exot.*, xxiii, no. 9, pp. 987–994, 3 refs. Paris, 1930.

The author discusses the flies observed to bite man at Stanleyville, Belgian Congo, namely, *Simulium damnosum*, Theo., *Phlebotomus schwetzi*, A., T. & P., *Culicoides grahami*, Aust., *C. milnei*, Aust., and *C. inornatipennis*, C., I. & M. In one locality in Bas Lomami, *Simulium medusaeformis*, Pomeroy, was found attacking man. *Culicoides confusus*, C., I. & M., occurs on the high plateaux of Kivu. These flies transmit various parasites of man and animals. *Filaria perstans* is widely spread in the vicinity of Stanleyville, and cases of infestation with *Onchocerca* occur in the Bas Lomami region where *S. damnosum* and *C. grahami* are numerous.

JAMES (S. P.). **Les résultats des recherches récentes sur la fièvre jaune envisagés au point de vue des mesures destinées à empêcher la propagation de la maladie.**—*Bull. Off. int. Hyg. publ.*, xxii, no. 12, pp. 2278–2290, 3 fldg. maps, 2 refs. Paris, December 1930.

This summary of the results of recent research on yellow fever includes a list of 12 mosquitos that have been shown to be experimental vectors of the disease.

Dinger (J. F.), Schüffner (W. A. P.) & Snijders (E. P.). **Untersuchungen über Gelbfieber in den Niederlanden. Impfversuche an Meerschweinchen.** [Investigations in Holland on Yellow Fever. Inoculation Experiments with Guineapigs.]—*Zbl. Bakt.* (1 Orig.), cxix, no. 1–2, pp. 1–11, 4 refs. Jena, 8th December 1930.

In continuation of previous investigations [*R.A.E.*, B, xviii, 261], yellow fever was transmitted from *Macacus rhesus* to guineapigs, both by injection and by the bites of *Aëdes argenteus*, Poir. (*aegypti*, auct.). In guineapigs the disease runs a quite different course to that in man or monkeys. It is transmissible from one guineapig to another either by injection or by *A. argenteus*. From the first guineapig infected typical yellow fever could be transmitted to *M. rhesus*, but this was not possible after further passages through guineapigs, either by blood or liver emulsion, or by *A. argenteus*.

Philip (C. B.). **Possibility of mechanical Transmission by Insects in experimental Yellow Fever.**—*Ann. Trop. Med. Parasit.*, xxiv, no. 4, pp. 493–501, 9 refs. Liverpool, 18th December 1930.

The following is taken largely from the author's summary and conclusions: *Aëdes argenteus*, Poir. (*aegypti*, auct.) and *Cimex lectularius*, L., were tested for the power to transmit yellow fever mechanically from infected to normal monkeys (*Macacus rhesus*). Negative results were obtained in three experiments in which from 39 to at least 100 mosquitos were used. The mosquitos were given partial feeds on experimentally infected animals during the initial fever and were subsequently allowed to complete engorgement on normal susceptible monkeys. Two methods of interruption during blood-meals were employed. Nine adults of *C. lectularius*, with about 50 in the larval and nymphal stages, also failed to infect a normal monkey during 7 alternate transfers between the normal monkey and the infected one during one feeding. The possibility of mechanical transfer of the virus by regurgitation during intermittent feeding of mosquitos is discussed; the experiments described support the opinion that regurgitation, if it occurs at all, does not effect the mechanical transfer of the virus. Infection was produced when saline emulsions of 100 or more individuals of the common monkey louse, *Pedicinus* sp., were injected into a normal monkey immediately after their removal from infected animals. It seems reasonable to suppose, however, that chances for infection through monkey lice are small, since no cross-infections that could be assigned to this cause were observed during the handling of considerable numbers of infested monkeys separated only by the sides of the cages. It is concluded that the chances for aggravation of yellow fever epidemics by mechanical transfer of the virus by insects that feed intermittently appear to be remote.

Hicks (E. P.). **The early Stages of the Jigger,** *Tunga penetrans*.—*Ann. Trop. Med. Parasit.*, xxiv, no. 4, pp. 575–586, 4 figs., 16 refs. Liverpool, 18th December 1930.

After giving an account of the methods used in rearing and mounting his material, the author describes the immature stages of *Tunga penetrans*, L., from Sierra Leone. The larva hatches 3 or 4 days after the egg is laid, and pupation takes place 7 to 14 days later. Development from egg to adult requires at least 17 days.

Evans (A. M.). **On certain distinguishing Characters observed in** *Anopheles funestus* **Giles.**—*Ann. Trop. Med. Parasit.*, xxiv, no. 4, pp. 587–592, 2 figs., 6 refs. Liverpool, 18th December 1930.

A comparison between the description of the larvae of *Anopheles minimus*, Theo., from the Philippines, given by Manalang in a paper already noticed [*R.A.E.*, B, xix, 5], and those of a series of *A. funestus*, Giles, bred from the type locality (Sierra Leone), led to the discovery of a well-marked difference in the fronto-clypeal pattern, which may perhaps be of value in further establishing the distinctness of *A. funestus* from *A. minimus* and possibly also from *A. listoni*, List., and *A. aconitus*, Dön. Moreover, investigation of the male palps of the African *A. funestus* shows what appears to be a constant difference between this species and *A. minimus*, *A. listoni* and *A. aconitus*.

[Ananyan (S. A.).] **Ананян (С. А.). Données préliminaires sur la parasitologie du paludisme en Arménie.** [*In Russian.*]—*Rev. Microbiol.*, ix, no. 2, pp. 231–235, 1 map. Saratov, 1930. (With a Summary in French, p. 285.)

Observations were carried out in 1925–27 on the distribution of malaria parasites in the basins of the rivers Arax and Kura, which are the endemic regions of the disease in Armenia. *Plasmodium vivax* was most frequently encountered, and *P. malariae* was about twice as numerous as *P. falciparum* (*immaculatum*, *praecox*). Conditions for the development in mosquitos of the first two species are favourable in the plains, with a temperature of 16·5–17° C. [60·8–62·6° F.]; *P. falciparum* is found in mountainous districts where there is more sun. Benign tertian malaria occurs in April, May and June, being followed from August till December by the malignant form, and in November-December by quartan malaria, which reaches its peak in January and February. *Anopheles maculipennis*, Mg., occurred everywhere, being usually the predominant species, but *A. hyrcanus* var. *pseudopictus*, Grassi, was abundant in the plains, and *A. superpictus*, Grassi, in the mountains, where the clean water of the springs offers suitable conditions for the larvae, and the occurrence of the adults coincides with that of malignant tertian malaria. Other Anophelines found were *A. bifurcatus*, L., *A. plumbeus*, Steph., and an unidentified species.

[Zotov (M. P.).] **Зотов (М. П.). Experiments in Breeding Sandflies in the Laboratory.** [*In Russian.*]—*Rev. Microbiol.*, ix, no. 2, pp. 236–243, 7 figs., 13 refs. Saratov, 1930. (With a Summary in English, p. 286.)

An account is given of laboratory experiments carried out in June-November 1929 in Sebastopol on the breeding of *Phlebotomus papatasii*, Scop., which is the only sandfly found there [*R.A.E.*, B, xvii, 235]. Over 5,000 adults were captured at various dates by means of test tubes containing a small paper funnel [xix, 54], the sandflies being caught in inhabited houses only (particularly in a damp basement), as none occurred in animal quarters. The first individuals were observed on 13th June and the last on 6th November.

The method used for breeding was one already noticed [xiv, 139]. About 40 females were usually placed under a lamp glass at a time;

they oviposited on the second, third, and sometimes even on the seventh day, the eggs being laid in batches or chains on damp filter paper at a distance of about an inch from the food material, and sometimes on the lower part of the glass. Oviposition took place from mid-June till the beginning of November, except when the temperature fell to 12–14° C. [53·6–57·2° F.]. The number of eggs laid by a female varied in different months (2–8 in June, 30–40 in August and 4–6 at the end of September). In order to safeguard the eggs and larvae from black mould, *Penicillium glaucum*, which developed on the food material, the eggs were usually transferred to other Petri dishes 24 hours after they had been deposited, and placed on the damp filter paper near the food material, which was not moistened. Incubation lasted 8–12 days, but no eggs hatched if they were deposited on too moist or completely dry paper, or on dry glass, unless they were transferred to the moderately damp filter paper. The optimum temperature for the development of the larvae was 20–26° C. [68–78·8° F.]; it was retarded by lower temperatures, and at 12–14° C. [53·6–57·2° F.], the larvae of the first three instars died, and those of the fourth buried themselves in the food material. The larval stage lasted 26–38 days, and the pupal 13–16, pupation occurring outside the food material. Though larvae were killed by *Penicillium glaucum*, they readily fed on *Mucor mucedo*, and developed rapidly on a culture of this fungus. In the Crimea hibernation probably occurs in the fourth larval instar, which appears to be the most resistant; in the laboratory all the adults died in the autumn when the temperature fell to 10–12° C. [50–53·6° F.].

[Zasukhin (D. N.).] **Засухин (Д. Н.). Materials on the Knowledge of Ticks in Connection with the Problems of their Study in the South-east of the R.S.F.S.R.** [*In Russian.*]—*Rev. Microbiol.*, ix, no. 2, pp. 250–262. Saratov, 1930. (With a Summary in English, p. 287.)

This is a general and brief discussion, supported by data from the literature, on the rôle of ticks and mites in the transmission of various diseases of man and animals. A list is given of the ticks and mites found in the years 1924–29 in the Lower Volga and Western Kazakstan and in the Russian Far East, showing their hosts. Their possible relation to diseases of man and animals is discussed, with notes from the literature, reference being made to the danger of plague transmission by species with many hosts such as *Rhipicephalus schulzei*, Olenev [*cf. R.A.E.*, B, xviii, 270].

[Tiflov (V. E.).] **Тифлов (В. Е.). The Fleas of Water Rats** (*Arvicola amphibius*) **in the South-east of the R.S.F.S.R.** [*In Russian.*]—*Rev. Microbiol.*, ix, no. 2, pp. 263–268, 2 figs., 7 refs. Saratov, 1930. (With a Summary in English, p. 288.)

In the summer of 1928 an epidemic of tularaemia occurred in the Orenburg Government among persons engaged in catching and skinning water rats (*Arvicola amphibius*), which harbour the infection [*R.A.E.*, B, xviii, 63]. A list is given of the fleas found on these rodents and in their nests in the eastern part of the Orenburg Government and

in the environs of Ural'sk and Saratov, with brief notes on their hosts and distribution. About 80 per cent. of the fleas were *Ceratophyllus walkeri*, Roths., a description of both sexes of which is given. This species has apparently only hitherto been recorded from Britain.

Cazanove (—). **Recherches sur les causes de la persistance de la peste au Sénégal.**—*Bull. Off. int. Hyg. publ.*, xxii, no. 11, pp. 2103–2107. Paris, November 1930.

The results obtained by a Mission for the study of plague in Senegal during the period March–July 1929 are given in this paper. The flea index on rodents was highest in localities situated near the coast. *Mus rufinus* was taken most often and was also the species most highly parasitised [but *cf.* *R.A.E.*, B, xvii, 202]. All the fleas collected were *Xenopsylla cheopis*, Roths., with the exception of 105 individuals of *X. astia*, Roths., all of which came from localities further inland. Fleas infesting the soil of huts were all *X. cheopis*. In May, in a village burnt and abandoned owing to plague infection, living fleas were found in rat holes, 67 individuals of *X. cheopis* being taken in a single nest. In July, when the rainy season had begun and the sand was moist, no further fleas were observed. There is evidence that the fleas living apart from rodents in the native huts may become reservoirs of plague for an undetermined period [*cf.* xviii, 249, 269].

Russo (C.). **Recherches expérimentales sur l'épidémiogenèse de la peste bubonique par les insectes.**—*Bull. Off. int. Hyg. publ.*, xxii, no. 11, pp. 2108–2120, 1 ref. Paris, November 1930.

An account is given of further experiments carried out in Italy on the part played in the transmission of plague by insects that habitually feed on the dead bodies of infected rats [*R.A.E.*, B, xiii, 181]. The carcases are attacked by the insects in the following almost regular sequence : *Musca domestica*, L., and *Calliphora vomitoria*, L. ; *Sarcophaga carnaria*, L. ; *Lucilia caesar*, L. ; when the fat, exposed to the air, becomes rancid, beetles of the genus *Dermestes* ; at the beginning of the brown liquefaction, those of the genus *Hister* ; and when the liquid products have largely disappeared, species of the genus *Tenebrio* and mites of the genera *Glyciphagus* and *Tyroglyphus*, which feed on the ligaments, tendons, bones, etc.

Fly larvae taken from infected rats, and pupae and adults reared from them, were tested for the presence of plague bacilli, and in all cases positive results were obtained. *Bacillus pestis* was also found in the dejecta of these flies but not in the ovaries. It appears that under natural conditions, the larvae, pupae and adults of the flies may harbour the plague bacillus (which has no apparent effect on their development) without modifying its original virulence. Examination of *Dermestes lardarius*, L., and *Hister cadaverinus*, Hoffm., from the remains of infected rats gave negative results, as did also tests on beetles of the same genera left in contact for four days with the liver of an infected guineapig.

Large numbers of apparently lifeless mites of the genus *Glyciphagus*, particularly *G. domesticus*, DeG., were found on dried-up, mummified rats. Thermo-precipitin reactions were positive for both rats and mites. Mites taken from the same source were rubbed into the scarified skin of two young guineapigs, which died of plague 4 and 5

days later. Uninfected mites taken from linseed and placed with dried liver from an infected guineapig became immobile and died, and plague bacilli were obtained from them. Subsequent experiments showed that in dead mites, the plague bacillus may survive for varying lengths of time according to conditions (4–5 days at 8–10° C. [46·4–50° F.]), and that its virulence diminished as its vitality decreased. It is concluded that although mites can be infected under favourable conditions, owing to their rapid death and the brief survival of the plague bacillus, their rôle in transmission, either direct or indirect, is limited.

In view of the possible importance of pests of cereals in the spread of plague, a second series of experiments was carried out. A sample of maize infested with immobile mites, subsequently proved to be plague-infected, was taken from a heap in which a mummified rat was found. Inoculation of these mites through the scarified skin of guinea-pigs produced plague infection, and the animals died on the fourth day. Other samples taken from the heap at a distance of 1–2 yards from the first were infested by *Glyciphagus domesticus*, *Cheyletus eruditus*, Schr., *Calandra* (*Sitophilus*) *granaria*, L., and *Tenebrio molitor*, L., but examination of these insects for *B. pestis* gave negative results. *C. granaria* and *T. molitor*, kept for several days in Petri dishes containing liver from an infected guineapig, rapidly became infected and eliminated, with their dejecta, living bacilli, the virulence of which diminished from the fourth or fifth day and disappeared completely after 10 days. Healthy larvae of these two species, placed under a watch glass on the abdomen of an inoculated guineapig, fed on the skin and became infected.

Although *B. pestis* was found in ants that had been in contact with an infected rat, when isolated from their dejecta and inoculated into a guineapig, it was found to be non-virulent. The virulence was recovered by two or three successive passages through guineapigs. Mites from cereals were placed with cultures of *B. pestis* in 15 flasks and one flask was examined on each of 15 successive days. The mites became infected from the second day and were motionless at the end of 4–5 days. The bacillus was isolated from these mites up to the 10th day, the last 5 flasks giving negative results. It is suggested, therefore, that grain containing parasites infected with plague should be cleared of rats, placed in rat-proof lighters, warehouses, etc., and treated with an insecticide or left in store for at least 14 days before being released for distribution.

Recent Developments in Blowfly Research.—*J. Council Sci. Ind. Res.*, iii, no. 4, pp. 212–219. Melbourne, November 1930.

An annual loss estimated at four million sterling is caused by blow-flies attacking sheep in Australia. Although seven species have been bred from living sheep, only a few of these are of major importance, the most injurious being *Lucilia sericata*, Mg. This species is present in all parts of the world where a serious blow-fly problem exists. The onset of a serious infestation of sheep in one district in Western Australia apparently followed its appearance 3 or 4 years previously. Since *Lucilia* is the first to be attracted to a carcass [*cf. R.A.E.*, B, xviii, 273] during the early stages of its decomposition, it seems probable that the fermentative processes that occur in the wool of sheep, particularly if wet or soiled, have a greater attraction for it than for other blow-

flies. Other flies to be attracted to carcasses in order of priority are *Calliphora stygia*, F., and *Anastellorhina* (*C.*) *augur*, F., and *Chrysomyia rufifacies*, Macq. The first two have been bred from living sheep in considerable numbers, and are occasionally the primary cause of the infestation. In the majority of instances, however, it is probable that they are preceded by *Lucilia*, and that when present alone they can infest only a small percentage of a flock. Observations on *Chrysomyia rufifacies* show that it does not oviposit until some change has been produced in the medium by the larvae of *Lucilia* or *Calliphora*, and that its larvae only mature normally when able to feed on those of other blow-flies as well as on altered tissues of the carcass. The insect population of a carcass in its different stages of decomposition is discussed ; observations show that a given species can only thrive during a particular stage of decomposition. If, therefore, control of *Lucilia* by means of poisoning or destroying carcases is desired, attention must be concentrated on those in the first and early second stages of decomposition. Although such factors as competition for food and the action of natural enemies greatly reduce the numbers of the emerging flies, even these depleted numbers, owing to their great fecundity and capacity for discovering new breeding-places, can find every breeding-place in the country and overcrowd it with their progeny. The amount of food available for the larvae is definitely a primary factor limiting the abundance of the flies [*cf. loc. cit.*]. The effect of natural enemies and the mortality of the adults before the eggs are laid only tend to reduce the intensity of competition, and there is no indication that these two factors ever reduce the flies to a point when competition no longer occurs, and therefore become themselves the primary factors limiting the abundance of the flies. From the uniformity with which competition can be observed, it is certain that the blow-fly population of the country is greatly in excess of the number that would be required to occupy all available carrion, and any attempt to reduce the population to a point at which the flies no longer fill their environment must account for this enormous surplus before it can have any practical effect. There is actually a great variation in abundance of the species at different times of the year, which is due to the effect of climate as well as environment on them. During the winter the first stage of decomposition is greatly prolonged, but *C. stygia* is the only species that is able to take advantage of this, since the other species are hibernating. During spring and autumn conditions are still favourable for *Lucilia*, but as the weather becomes warmer, these become more limited in duration, until with the appearance of *Chrysomyia* the whole environment becomes unfavourable to the smooth maggots.

TILLYARD (R. J.). **The Work of the Division of Economic Entomology for the Year 1929/30.**—34 pp. typescript. [Canberra, Council Sci. Ind. Res., 1930.]

Most of the information on blow-fly research contained in this report is noticed in the preceding abstract. Observations on *Lucilia sericata*, Mg., in France [*cf. R.A.E.*, B, xviii, 158, 273] indicated that infestation by parasitic Hymenoptera was negligible until the autumn, when *Alysia manducator*, Panz., became very numerous. Even then competition by Sarcophagids remained pronounced, greatly limiting the

effectiveness of the parasite, in that mostly male individuals of *Alysia* were observed to emerge from small puparia of *L. sericata*.

Investigations on the buffalo fly [*Lyperosia exigua*, de Meij.], which attacks buffalos, cattle, horses, donkeys, and occasionally man in Northern Australia, are discussed. Dogs, pigs and goats were not observed to be attacked. A study of the means of dispersal of the flies show that when travelling with cattle they will breed in the dung dropped by them and infest other herds passing along the same route. In favourable circumstances the flies will remain on travelling cattle and horses for at least 10 days, and may thus be carried long distances. The dung of cattle only remains suitable for larval development for a limited number of days. Under favourable conditions the larvae can complete their development in 4–5 days. Investigations in the laboratory indicate that the water content of the dung is an important determining factor for the maturation of the larvae, and therefore districts with heavy rainfall may be just as unfavourable as arid regions.

Spalangia sp. and *Phaenopria* sp. are the only two parasites yet known to attack the flies in Australia. Observations indicate that *Lyperosia* becomes a pest of economic importance when its numbers exceed 1,000 individuals to each host animal. During the wet season a concentration of 2,000 to 5,000 flies to a host is a usual occurrence.

Investigations conducted in Java show that the concentration is below 200 individuals to each animal, and frequently only 5 or 10. Buffalos and all breeds of cattle, but not horses or other animals, are attacked. Various parasites, which confine their attacks to the pupal stage of the fly only, are known to occur. The examination of 16,000 puparia revealed a parasitism of 5·49 per cent., *Spalangia* sp. being the predominant species concerned.

VEITCH (R.). **Report of the Chief Entomologist.**—*Ann. Rep. Dept. Agric. Queensland 1928–29*, pp. 67–71. Brisbane, 1929. [Recd. Jan. 1931.]

Lyperosia exigua, de Meij. (buffalo fly) was found in 1928 to have spread from Northern Australia into the extreme north-western corner of Queensland, where appropriate quarantine measures have been taken.

VANDENBERG (S. R.). **Report of the Entomologist.**—*Rep. Guam Agric. Expt. Sta. 1928*, pp. 23–31. Washington, D.C., 1930.

A species of *Spalangia* parasitic on the pupae of the house-fly [*Musca* sp.] has been introduced into Guam from Hawaii, and has become established locally. The parasites prefer newly transformed fly pupae to older ones. The time from egg to adult in breeding-jars was 15 to 17 days ; the method of breeding is briefly described.

MACDOUGALL (R. S.). **The Warble Fly Problem. Report on Experiments conducted in Scotland in 1930.**—36 pp., 5 refs. Edinburgh, Highl. Agric. Soc. Scotland, 1930.

Details are given of experiments carried out in Scotland in 1930 with five proprietary dressings for the control of *Hypoderma bovis*, DeG., and *H. lineatum*, Vill., in cattle. A wash of derris powder and soft

soap [*R.A.E.*, B, xviii, 204] gave very satisfactory results, 2,785 larvae being killed out of 3,035 treated. In mixing it care should be taken that the boiling water in which the soap is dissolved is cooled to blood heat at least before being poured on to the derris powder, or the active principle of the latter may be affected. The distribution of the two species of *Hypoderma* in Scotland is given, and previous observations that *H. lineatum* develops earlier than *H. bovis* are confirmed. As regards "rose fever," larvae were broken in the backs of three cows but no untoward symptoms were observed [*cf.* viii, 82, 83 ; xix, 21].

PINTO (C.) & DA FONSECA (F.). **Novo genero e nova especie de mosca hematophaga da sub-familia Stomoxydinae, hospedadora intermedia da** *Dermatobia hominis.* **Novos hospedadores intermediarios da** *Dermatobia hominis* **(L. Junior, 1781) "Diptera, Oestridae."** [A new Genus and new Species of Blood-sucking Fly of the Sub-family STOMOXINAE, an intermediate Host of *D. hominis.* New intermediate Hosts of *D. hominis.*]—*Rev. med.-cirurg. Brasil,* xxxviii, no. 7, reprint 13 pp., 4 pls. Rio de Janeiro, July 1930.

Neivamyia lutzi, gen. et sp. n., is described from Rio de Janeiro, where two individuals taken from horses were found carrying eggs of *Dermatobia hominis,* Say. A list is given of the 43 known species of STOMOXINAE. Additional flies found to carry the eggs of *Dermatobia* in Rio de Janeiro are *Stomoxys calcitrans,* L., *Sarcophaga terminalis,* Wied., and a Cordylurid, *Pselaphephila* sp.

O'ROKE (E. C.). **The Morphology, Transmission, and Life-history of** *Haemoproteus lophortyx* **O'Roke, a Blood Parasite of the California Valley Quail.**—*Univ. California Pub. Zool.,* xxxvi, no. 1, pp. 1–50, 2 pls., 6 figs., 2 pp. refs. Berkeley, Cal., 22nd November 1930.

Haemaproteus lophortyx, sp. n., which was found in the blood of various species of quail (*Lophortyx*) in California, is apparently transmitted by the Hippoboscid, *Lynchia hirsuta,* Ferris. Actual attempts to transmit the parasite by the bite of the fly failed, owing to the small number of flies available, but sporozoites were found in oöcysts on the mid-gut, among the tissues of the haemocoele, and in the salivary glands of flies taken on an infected quail, and in one case, transmission was accomplished by injecting sporozoites from an infected fly into the blood of a quail.

NICOLLE (C.), ANDERSON (C.) & LE CHUITON (F.). **Sur l'existence, en Tunisie, de la fièvre récurrente espagnole.**—*C. R. Acad. Sci. Fr.,* cxcii, pp. 194–196, 1 ref. Paris, 1931.

The anticipated spread of *Spirochaeta hispanica* [var. *marocana*] to Tunisia [*R.A.E.*, B, xviii, 62] is confirmed by a case of relapsing fever at Sidi Abdallah. Inoculation of the blood into a guinea-pig showed the spirochaete to belong to the group of *S. hispanica.* Infection caused by it in guineapigs, rats, mice and a monkey gave no immunity from *S. duttoni*, *S. normandi*, or two strains of *S. hispanica,* nor did these four give immunity to the new strain. The

tests with S. *duttoni* are not yet complete. Although transmission of the spirochaete was obtained by both adults and nymphs of *Ornithodorus erraticus*, Lucas, and *O. savignyi*, Aud., the nymphs only, as is usual [xix, 18], transmitted the infection by biting. Transmission was not obtained by lice [*Pediculus*]. In regard to the supposed part played by the porcupine as a reservoir of spirochaetes allied to *S. hispanica* [xix, 39, etc.], the authors point out that this animal disappeared from Spain over 60 years ago.

SERGENT (Ed.), DONATIEN (A.), PARROT (L.) & LESTOQUARD (F.). **Du mode de transmission de la theilériose bovine nord-africaine par la tique** *Hyalomma mauritanicum.—C.R. Acad. Sci. Fr.*, cxcii, pp. 253–255, 1 ref. Paris, 1931.

Having found that bovine piroplasmosis due to *Theileria dispar* could be transmitted in Algeria by *Hyalomma mauritanicum*, Senevet [*R.A.E.*, B, xvi, 267], the authors carried out experiments to determine the biological conditions of this transmission. These showed that ticks of either sex infected in the larval-nymphal stage transmit infection when adult. A single male can infect two calves, one after the other. Should the tick in the larval stage become detached from its first host it can transmit infection as a nymph. Infection can sometimes be transmitted within 60 hours of attachment to the host. Infection was not inherited by the offspring of ticks fed in the larval, nymphal or adult stages on infected cattle.

SERGENT (Ed.), DONATIEN (A.), PARROT (L.) & LESTOQUARD (F.). **Considérations étiologiques sur la theilériose bovine nord-africaine.** —*C.R. Acad. Sci. Fr.*, cxcii, pp. 393–395, 1 ref. Paris, 1931.

Bovine piroplasmosis caused by *Theileria dispar* appears in Algeria almost exclusively in the form of an annual outbreak that starts at the beginning of summer, has its peak in July, and ends at the beginning of September. Cattle, attacked for the first time when adult, usually succumb, while those that survive remain infective for at least 4 months to *Hyalomma mauritanicum*, Senevet, the vector of the disease. The virus persists also in cattle infected when young and which resist later attack. The larvae of the tick hatch in the autumn and remain attached for about 8 days as larvae and 8 as nymphs to their first host, which, if a survivor of the previous summer outbreak, infects them. The nymphs hibernate in dry sheltered places and moult with the first warm weather, the adults attaching themselves to, and infecting, a second animal. After 10–12 days the engorged females drop off, oviposit and die, the males dying soon afterwards. The eggs hatch after about 6 weeks. Cases of infection that occur at the end of summer are caused by exceptional conditions, such as successive infection of two cattle by the same male ticks, or infection by nymphs accidentally detached from their host at the end of the larval stage. The occasional cases occurring in the colder weather are due to infection by a few females that sometimes live till spring. The absence of hereditary transmission of the organism in the tick [see preceding paper] prevents the occurrence of an outbreak in the autumn.

NUTTALL (G. H. F.). **Le rôle pathogène des tiques.**—*Bruxelles-Méd.*, 1930, no. 50, reprint 8 pp. Brussels, 12th October 1930.

This is a general review of the relation of ticks to various diseases of man throughout the world, with brief notes on some of the measures adopted against them.

POOL (W. A.), BROWNLEE (A.) & WILSON (D. R.). **The Etiology of "Louping-ill."**—*J. Comp. Path.*, xliii, pt. 4, pp. 253–290, 2 charts, 17 refs. Croydon, December 1930.

In the course of this report, which deals with the results of certain inoculation experiments in connection with investigations on "louping-ill" disease of sheep and pigs in Britain, the author points out that although filtration experiments have given inconclusive results, other evidence suggests that louping-ill is a virus disease. The type of infection, together with the circumstantial evidence that in natural circumstances it is transmitted by ticks [*cf.* *R.A.E.*, B, xiv, 22], suggests the possibility that it may be associated with *Rickettsia*. The experiments carried out have not shown that any animals other than sheep or pigs are susceptible to the infection.

MARÇON (L.) & MARÇON (H.). **Sur un cas de fièvre exanthématique après inoculation intraoculaire accidentelle du sang d'une tique.**—*Bull. Soc. Path. exot.*, xxiii, no. 9, pp. 889–891. Paris, 1930.

The authors describe a case of exanthematic [Marseilles] fever in France, which was contracted by the patient receiving a drop of blood in the eye while crushing ticks from a dog with his finger nails.

BEQUAERT (J.). **Ticks collected by the American Museum Congo Expedition 1909–1915, with Notes on the Parasites and predacious Enemies of these Arthropods.**—*Amer. Mus. Nov.*, no. 426, 12 pp., 5 refs. New York, N.Y., 30th June 1930.

A list, with notes, is given of the ticks known from the Belgian Congo. Internal parasites recorded from ticks in various parts of the world are *Ixodiphagus caucurtei*, du Buysson, *I. texanus*, How., and *Hunterellus hookeri*, How. [*R.A.E.*, B, xvii, 123], but whether the last two are generically or specifically distinct from the first is open to doubt. The most effective predacious enemies of ticks are various birds, including domestic fowls.

PARKER (R. R.), HEARLE (E.) & BRUCE (E. A.). **The Occurrence of Tularaemia in British Columbia.**—*Publ. Hlth. Rep.*, xlvi, no. 2, pp. 45–46, 1 ref. Washington, D.C., 9th January 1931.

In the spring of 1930 *Bacterium tularense* was recovered from a snowshoe rabbit (*Lepus americanus columbiensis*) heavily infested with *Haemaphysalis leporispalustris*, Pack., in British Columbia, more than 200 miles north of the United States border. Guinea-pigs injected with an emulsion of the ticks contracted the disease. The first diagnosed case of tularaemia in man in Canada was reported in February 1930 from a locality in Ontario 400 miles north of the border. The occurrence of the disease in districts 1,500 miles apart thus suggests that it is probably a widespread infection of many years standing in Canada.

Transmission of Typhus Fever by Fleas.—*Science*, lxxiii, no. 1886, suppl. p. 10. New York, N.Y., 20th February 1931.

In experiments carried out by R. E. Dyer and L. F. Badger in Baltimore, fleas from rats taken in the vicinity of cases of endemic American typhus [Brill's disease] were crushed and injected into guineapigs. The latter contracted a disease like typhus, the clinical symptoms and the appearance of the organs and tissues corresponding with the symptoms in animals inoculated with a strain of American typhus fever, which varies slightly from that transmitted by lice in the Old World [*cf. R.A.E.*, B, xvii, 229, etc.]. Guineapigs that had recovered from an attack of endemic typhus produced by the New World strain appeared immune from infection by inoculation of the strain obtained from the flea emulsion.

Buxton (P. A.). **The Biology of a Blood-sucking Bug,** *Rhodnius prolixus*.—*Trans. Ent. Soc. London*, lxxviii, pt. 2, pp. 227–236, 8 refs. London, 31st December 1930.

A detailed account is given of the results of breeding experiments with the Reduviid, *Rhodnius prolixus*, Stål, which were carried out particularly with a view to determining the exact relation between sucking blood, sexual maturity and oviposition. It was found that the duration of the stages was extremely variable at a temperature of 24° C. [75·2° F.], at which all breeding was done. The average egg stage was found to vary between 14–16 and 20–22 days, though hatching occurred in isolated instances on the 10th and 37th days. The larva has five ecdyses and takes one blood meal between each. Blood meals are essential for both sexes before pairing and oviposition occur. The biology of this species is compared with that of *Cimex* [*lectularius*, L.].

Rivnay (E.). **Host Selection and Cannibalism in the Bed Bug** *Cimex lectularius* **L.**—*Ann. Ent. Soc. Amer.*, xxiii, no. 4, pp. 758–764, 10 refs. Columbus, Ohio, December 1930.

Experiments were carried out to determine whether heat is the only stimulus that attracts *Cimex lectularius*, L., to its host [*R.A.E.*, B, xviii, 223], since if, as has been suggested, preference is shown for man, there must be some other stimulus that is present in man and lacking in other animals. In experiments in which bugs collected from the cages of rodents were fed on man and others collected from mattresses were fed on rodents, tests being continued with offspring to the fourth generation, no preference whatever was shown in selecting the host. A further series of tests with cold-blooded vertebrates showed that although *C. lectularius* does not attack them under normal conditions, when the heat which reptiles give off is preserved or their temperatures are artificially raised far beyond that of their environment, when a scaleless surface is offered them, such as between the toes or joints, and when the surface moisture commonly present on amphibians is removed, the bugs feed freely upon these animals [*cf.* vi, 159]. The author further succeeded in making one of the bugs feed upon another, which, immediately after feeding upon his arm, had been slightly heated against a lamp to about 30° C. [86° F.]. He therefore concludes that cannibalism may take place under natural conditions immediately

after feeding, when the blood ingested by the bugs is still warm and doubtless radiates heat through the body walls of the insect. Although a normal and active bug would show resistance to attack, crippling due to bursting of the digestive tract frequently follows a meal and bugs in this state are unable to defend themselves.

ROBERTS (R. A.). **The wintering Habits of Muscoid Flies in Iowa.**—*Ann. Ent. Soc. Amer.*, xxiii, no. 4, pp. 784–792, 6 refs. Columbus, Ohio, December 1930.

Notes are given on 33 species of flies trapped, collected or observed at Ames, Iowa, during an investigation from 1st October 1927 to 5th May 1928. The weather was moderate, with a few periods of cold, the temperature falling on one occasion to $-25°$ F. The trap used was covered with 14-mesh screen wire, into the bottom of which was fitted a screen cone through which the flies entered. It was mounted on a platform $2\frac{1}{2}$ ft. square, 4 ft. above the ground. The bait usually consisted of fresh beef, of which about 2 lb. was placed in the bait pan each week. The flies were collected each week, and a random 500 determined as to species. Lists are given showing those trapped from 2nd October to 26th November and from 22nd March to 5th May, and of all species taken showing the last date in autumn and first date in spring on which adults were observed active under outdoor conditions. In autumn *Musca domestica*, L., was the most abundant species, the next five in order of abundance being the blow-flies, *Lucilia sericata*, Mg., *Phormia regina*, Mg., *Cynomyia cadaverina*, R.-D., *L. caesar*, L., and *Calliphora erythrocephala*, Mg. *Pollenia rudis*, F., and *Phormia regina* were taken out of doors at intervals, and *P. rudis* and *M. domestica* were present in heated buildings, during the entire winter. More than 50 per cent. of the spring catch was represented by *C. cadaverina* and 33 per cent. by *Phormia regina*, which increased rapidly in April and early May and became predominant over *Cynomyia*. *Lucilia* spp., which were present only in small numbers, appeared to be more abundant in wooded areas.

LAAKE (E. W.) & CUSHING (E. C.). **Fly Trapping on the Ranges of the Southwest.**—*J. Econ. Ent.*, xxiii, no. 6, pp. 966–972. Geneva, N.Y., December 1930.

Loss from *Cochliomyia macellaria*, F. (screw-worm fly) and *Phormia regina*, Mg. (fleece-worm fly) on the stock ranges of the south-western States, where the use of fly traps has become somewhat extensive, was estimated in 1928 at £2,000,000. Tests conducted in 1929 to determine the effectiveness of fly-trapping in reducing the number of flies over an area of approximately 200 sq. miles of ranch land in Texas using 313 traps, or approximately 1 to 407 acres, showed a reduction of 36·2 per cent. in the fly population in comparison with a similar untrapped area. A list is given of the numerous species of fly caught, of which *C. macellaria* and *P. regina* represented 85 per cent. The total fly population of the trapped area is estimated at over 234 millions. The period of greatest fly activity is from 1st March to 1st November, and little injury is caused during the winter months, when trapping may be discontinued. The most effective bait was found to be 2 lb. fresh meat (of goats or sheep) to which is added 2 U.S. gals. water and nicotine

sulphate at the rate of 4 cc. to 1 U.S. gal. water. The addition of nicotine sulphate inhibits the development of larvae and does not interfere with the normal decomposition of the meat or reduce its attractiveness to flies. The frequency of renewing baits and refilling bait pans with water is dependent upon weather conditions.

Essig (E. O.). **A modern Gnat Trap.**—*J. Econ. Ent.*, xxiii, no. 6, pp. 997–999, 1 pl., 1 ref. Geneva, N.Y., December 1930.

A trap found successful in catching *Chaoborus lacustris*, Freeborn, a midge that does not suck blood but is very troublesome on the shores of a large lake in California, is described. It is also likely to prove useful for other night-flying insects. It consists of a light to attract the insects, a small electric suction fan to remove them from the light and a thin cheesecloth bag to capture and hold the catch. The traps, which may be suspended at from 6 to 30 ft. above the ground, cost about £2 each. From 5 to 15 lb. of midges have been taken in one trap on a single evening in California, 1 lb. being estimated to contain about two million individuals.

Bradley (G. H.). *Hermetia illucens* **L.—A Pest of sanitary Privies in Louisiana.**—*J. Econ. Ent.*, xxiii, no. 6, pp. 1012–1013. Geneva, N.Y., December 1930.

Hermetia illucens, L., was found breeding in Louisiana during August and September 1930 in privy pits of an improved type which is described. The annoyance caused was in some cases so severe as to occasion persons to abandon the privies for those of the old surface type, thus interfering with the work of the health officials. A short study of the situation showed that the eggs are deposited in cracks and spiders' webs in the interior of the vent pipe, and the larvae, upon hatching, fall or crawl down through the screen at the bottom of the pipe into the pit where the larval and pupal stages are passed. Some of the larvae crawl up the sides and escape through the cracks to pupate in the earth outside, where additional annoyance is caused by fowls tearing down the earth mound in search of the pupae. A few tests with common oils, disinfectants and poisons showed that the larvae could be killed under some conditions by heavy applications of gas oil, and under others by a thin coating of Paris green, but the best solution appears to be a trap opening into the vault which will admit sufficient light to attract the emerging flies, or to allow them to escape, without admitting house flies and mosquitos. As *H. illucens* rarely enters dwellings or visits food-stuffs, the escape of the flies is of no particular sanitary importance.

Papers noticed by Title only.

Manalang (C.). **Does the Amount of Malaria depend on the Number of transmitting Mosquitoes?**—*J. Trop. Med. Hyg.*, xxxiv, no. 2, pp. 19–27, 13 refs. London, 15th January 1931. [*See R.A.E.*, B, xix, 51.]

Collins (B. J.). **The confused Nomenclature of** *Nycteribia* **Latreille, 1796, and** *Spinturnix* **Heyden, 1826.**—*Bull. Nat. Inst. Health*, no. 155, pp. 743–765, 769–789, 11 figs. Washington, D.C., 1931.

Stiles (C. W.) & Nolan (M. O.). **Key-catalogue of Parasites reported for Chiroptera (Bats) with their possible Public Health Importance.**—*Bull. Nat. Inst. Health*, no. 155, pp. 603–742, 767–789. Washington, D.C., 1931.

Ross (Sir R.) & Watson (Sir M.). **A Summary of Facts regarding Malaria suitable for Public Instruction.**—Demy 8vo, 15 pp. London, J. Murray, 2nd edn., 1930. Price 6*d.*

Schwardt (H. H.) **Notes on the immature Stages of Arkansas Tabanidae.**—*J. Kansas Ent. Soc.*, iv, no. 1, pp. 1–15, 11 refs. McPherson, Kans., January 1931.

Schwardt (H. H.) & Hall (D. G.). **Preliminary Studies on Arkansas Horse-flies** [including Keys to Genera of Tabanids in U.S.A. and to Species of *Chrysops* and *Tabanus* in Louisiana and Arkansas].—*Bull. Arkansas Agric. Expt. Sta.*, no. 256, 27 pp., 14 figs., 8 refs. Fayetteville, Ark., May 1930. [Recd. March 1931.]

Covell (G.). **The Malaria Problem in Bombay.**—*J. Bombay Nat. Hist. Soc.*, xxxiv, no. 3, pp. 736–742, 1 pl., 4 refs. Bombay, 15th November 1930. [*Cf. R.A.E.*, B, xviii, 73.]

Aschner (M.). **Die Bakterienflora der Pupiparen (Diptera). Eine Symbiosestudie an blutsaugenden Insekten.** [Bacteria of Pupipara (Hippoboscids, Nycteribiids and Streblids). A symbiotic Study of blood-sucking Insects.]—*Z. Morph. Oekol. Tiere*, xx, no. 2–3, pp. 368–442, 5 pls., 5 figs., 46 refs. Berlin, 17th January 1931.

Koidzumi (M.). **The Anophelines of Formosa.**—*Riv. Malariol.*, ix, no. 3, pp. 232–235. Rome, 1930. [*Cf. R.A.E.*, B, xiii, 185.]

Del Ponte (E.). **Catálogo descriptivo de los géneros** *Triatoma* **Lap.,** *Rhodnius* **Stål y** *Eratyrus* **Stål.**—*Rev. Inst. bact.*, v, no. 8, pp. 855–937, 13 pls., 25 figs., 2 pp. refs. Buenos Aires, November 1930.

da Costa Lima (A.). **Sobre especies do genero** *Miamyia*, **subgénero** *Miamyia* **(2a Nota).** [Species of *Miamyia*, Subgenus *Miamyia*, from Brazil. (2nd Note).]—*Mem. Inst. Oswaldo Cruz*, xxiv, fasc. 3, pp. 187–194, 3 pls. Rio de Janeiro, 1930. [Specific Key and Description of *M. pintoi*, sp. n., from Internodes of Bamboos.] [*Cf. R.A.E.*, B, xix, 16.]

Hadlington (E.). **The Fowl Tick** [*Argas persicus*, Oken].—6 pp., 4 figs. Sydney, Dept. Agric. N.S.W., 1929. [*Cf. R.A.E.*, B, vii, 67.] [Recd. December 1930.]

Daubney (R.). **Heartwater** (*Rickettsia ruminantium*).—*Ann. Rep. Dept. Agric. Kenya 1929*, pp. 325–332. Nairobi, 1930. [*Cf. R.A.E.*, B, xviii, 220.]

Bequaert (J.). **Synopsis des tiques du Congo belge** [with Keys].—*Rev. Zool. Bot. afr.*, xx, no. 3, pp. 209–251, 57 refs. Brussels, 1st March 1931.

Jancke (O.). **Zur Kenntnis der männlichen Kaudalregion der Anopluren.** [Contribution to the Knowledge of the Male caudal Region of the Anoplura.]—*Z. Parasitenk.*, iii, no. 1, pp. 1–7, 13 figs., 2 refs. Berlin, 17th December 1930.

Schulze (P.). **Die Zeckengattung** *Hyalomma*. **I.** (*H. aegyptium* **L.,** *detritum* **P. Sch.,** *volgense* **P. Sch. u. Schlottke,** *H. scupense* **P. Sch. und** *H. uralense* **P. Sch. u. Schlottke.**) [The Tick Genus *Hyalomma*. I.]—*Z. Parasitenk.*, iii, no. 1, pp. 22–48, 44 figs., 20 refs. Berlin, 17th December 1930.

ROBERTS (F. H. S.). **A Poultry Mite infesting Dwellings.**—*Queensland Agric. J.*, xxxiv, pt. 6, pp. 595–596, 1 fig. Brisbane, 1st December 1930.

Liponyssus bursa, Berl. (tropical poultry mite) is recorded as infesting houses and attacking man in Queensland during 1930. This mite usually infests the nests and surroundings of domestic fowls, only attacking the birds when food is required. At times it causes much discomfort to nesting hens and may cause the death of newly hatched chickens. The eggs are laid away from the host. It has also been found on the domestic pigeon and common sparrow, and is probably carried from one locality to another mainly by these hosts. Both pigeons and sparrows nest on houses, and when the birds leave the nest many of the parasites descend into the dwellings and attack any animal with which they come into contact. In the cases mentioned, the infestations were traced to nests vacated by pigeons. Fortunately the mites are only able to live about 10 days away from their warmer-blooded avian hosts and appear to be incapable of breeding under these circumstances.

To eradicate the mites, nests of pigeons and sparrows should be removed, and the premises thoroughly sprayed with a carbolic solution or some other efficient insecticide, such as one containing pyrethrum. For the treatment of bites, the bathing of the affected parts with a weak carbolic acid solution (1 : 40) and the application of an ointment consisting of 15 parts beta-napthhol, 100 parts lard, 50 parts soft soap and 10 parts lanoline are recommended.

KINGSBURY (A. N.). **Annual Report of the Institute for Medical Research for the Year 1929.**—*Ann. Rep. Med. Dept. F.M.S. 1929*, pp. 51–107. Also separately published, 86 pp. Kuala Lumpur, 1930.

Transmission of tropical typhus by *Pediculus humanus*, L. (*corporis'* DeG.) and the head louse [*P. capitis*, DeG.] has been successful under experimental conditions (using inoculations of crushed lice), but the former does not appear to exist in Malaya, and transmission by the latter would be at variance with epidemiological observations on oil palm estates [*cf. R.A.E.*, B, xvii, 185 ; xviii, 14 ; xix, 41]. A total of 464 examinations of coolies working among oil palms in the endemic area yielded 88 Arthropods, the majority of which were larval Trombiculids. The commonest mite on man was *Trombicula akamushi*, Brumpt, and since Japanese river fever [tsutsugamushi disease] has already occurred in this area [*cf.* xvi, 101, 261 ; xvii, 12], it would appear that this species is more likely to be the vector of tropical typhus than *T. deliensis*, Walch. On rats *Xenopsylla cheopis*, Roths., was almost the only flea found, the plague-flea index rising to 4 in September. Protonymphs of a species of *Dermanyssus* were found on a few rats and *T. deliensis* was common.

Work on mosquitos included studies on the factors that influence the infectivity of malaria gametocyte carriers to *Anopheles maculatus*, Theo. ; most of the results have already been noticed [*R.A.E.*, B, xviii, 193]. A revision of the Malayan species of *Anopheles* [*cf.* xviii, 14] has shown that the species hitherto recorded as *A. fuliginosus*, Giles, was much more usually *A. philippinensis*, Ludl., but that the former species does occur in small numbers in the north of Malaya.

[Olenev (N. O.).] **Оленев (Н. О.). Résultats scientifiques des travaux des expéditions de 1928 et 1929 pour l'étude des parasites des animaux domestiques au Kazakstan.** [*In Russian.*]—*C.R. Acad. Sci. U.R.S.S.*, 1930, no. 22, pp. 604–610, 1 fig., 6 refs. Leningrad, 1930.

A list is given of 91 species of Arthropods collected during expeditions to Kazakstan in the summers of 1928 and 1929, and found chiefly on domestic animals, indicating their local distribution and hosts. A report on the expedition of 1928 has already been noticed [*R.A.E.*, B, xvii, 154].

Schwartz (B.), Imes (M.) & Wright (W. H.). **Parasites and parasitic Diseases of Horses.**—*Circ. U.S. Dept. Agric.*, no. 148, 54 pp., 36 figs., 2 refs. Washington, D.C., November 1930.

The information in the sections of this paper that deal with the Arthropod parasites of horses in the United States has already been noticed [*R.A.E.*, B, xv, 7, 50].

Nobre (A. F.). **Animais venenosos de Portugal. I.** [Poisonous Animals of Portugal.]—Med. 8vo, 83 pp., 48 figs. Oporto, Inst. Zool. Univ. Pôrto, 1928. [Recd. December 1930.]

This survey of marine and terrestrial animals more or less poisonous to man in various ways includes a number of insects, such as urticating caterpillars, Telephorid and Meloid beetles, wasps and bees.

Gibson (A.). **Insect and other external Parasites of Poultry in Canada.**—*Sci. Agric.*, xi, no. 4, pp. 208–220, 27 refs. Ottawa, December 1930.

This paper is a brief review of the literature on Arthropods liable to be injurious to poultry in Canada, including mites, ticks, lice, fleas, Simuliids, mosquitos and beetles.

Hindwood (K. A.). **A sub-cutaneous avian Parasite.**—*Emu*, xxx, pp. 131–137, 1 pl., 4 figs., 1 ref. Melbourne, 1930.

Observations are recorded on *Passeromyia longicornis*, Macq., the larvae of which were found on nestlings of two species of birds. In one case, 31 larvae were obtained from a single bird, and 5 more and 15 pupae from the bark of branches adjacent to the nest. All stages of *P. longicornis*, the known range of which is Eastern Australia and Tasmania, are briefly described, with notes on its synonymy and a list of the birds from which it has been recorded. According to P. A. Gilbert, oviposition, which is not confined to any one species of bird, usually takes place beneath the wing, the larvae dispersing over the body on hatching and feeding on the blood of the young bird. The larva, which takes 6 days to reach maturity, moves under the skin as it grows, always leaving the posterior segment slightly protruding. The pupal period generally lasts 15 days.

Baird (W. H. W.). **Veterinary entomological Research.**—*Ann. Rep. Dept. Vet. Sci. Anim. Husb. Tanganyika Terr. 1929*, pp. 41–48. Dar-es-Salaam, 1930.

Mange caused by *Sarcoptes caprae*, Fürst., is a serious disease of goats in Tanganyika Territory and may be responsible for a heavy mortality. Although cases of spontaneous recovery undoubtedly occur, the disease should be treated without delay as soon as it appears. The effects of dipping were found to be very slow, but beneficial results were obtained when a small flock was treated by hand with a dressing consisting of 50 parts sulphur, 25 parts tar oil and 400 parts used motor engine oil. The goats were treated all over every third day until 10 applications had been made, and at the end of this time the lesions had almost entirely disappeared.

Negative results were obtained in experiments on the transmission of *Trypanosoma congolense* and *T. brucei* from infected to healthy guineapigs by means of interrupted feedings of *Stomoxys calcitrans*, L.

Vroom (E.). *Dermanyssus avium* **en haar beteekenis voor de overbrenging van vogelcholera.** [*D. gallinae* and its Significance in the Transmission of Bird Cholera.]—Med. 8vo, 120 pp., 3 pls., 5 pp. refs. Groningen, Thesis, R.-Univ. Utrecht, 1930. (With a Summary in German.)

A survey is given of the literature on the possible relation of Arthropods, particularly *Dermanyssus gallinae*, DeG. (*avium*, Dugès), to fowl cholera and other diseases of the haemorrhagic septicaemia group, and on the morphology and biology of *D. gallinae*. The mites collect in colonies, especially at low temperatures, but become active and disperse in search of food when the temperature rises. Gentle tapping on the breeding chamber brings the unfed mites out of their shelters, and this was made use of for the purpose of collecting them. A full account is given of 150 experiments with about 60,000 mites. These showed that the bacilli retain their virulence for long periods in the intestine of the mite, being still found in unfed individuals after 120 days. At first they occur in abundance in the excreta, usually not after 15 days after ingestion of blood, but sometimes up to 49 days. Infection was not transmitted by the sucking of blood by mites, but occurred when fowls were fed on infected individuals, and this is probably the method of infection in nature. Some comparative experiments were made with *Stomoxys calcitrans*, L., *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.), and *Ornithodorus moubata*, Murr., but the bacilli survived for only a few days in these Arthropods.

Nieschulz (O.). **Surraübertragungsversuche auf Java und Sumatra.** [Surra Transmission Experiments in Java and Sumatra.]—*Veeartsenijk. Meded.*, no. 75, 296 pp., 8 pls., 7 pp. refs. Buitenzorg, 1930.

Most of the information in this monograph on the author's investigations in Java and Sumatra over a period of four years on the transmission of surra, in which definite results were only obtained with blood-sucking Diptera, has already been noticed from his numerous communications on the subject [*R.A.E.*, B, xvii, 210, 231, etc.].

Meyer (A.). **Infektion, Entwicklung und Wachstum des Riesenkratzers** (*Macracanthorhynchus hirudinaceus* (**Pall.**) **im Zwischenwirt.** [Infection, Development and Growth of *M. hirudinaceus* in the intermediate Host.]—*Zool. Anz.*, xciii, no. 5–6, pp. 163–172, 9 figs., 4 refs. Leipzig, 15th February 1931.

An account is given of the results of investigations on the development of *Macracanthorhynchus hirudinaceus* in the larvae of Lamellicorn beetles. Pigs become infected by ingesting the beetle larvae.

Sanders (D. A.). **Manson's Eyeworm of Poultry.**—*Bull. Florida Agric. Expt. Sta.*, no. 206, pp. 567–585, 3 figs., 11 refs. Gainesville, Fla., June 1929. [Recd. 1931.]

Studies on the infestation of fowls by the Nematode, *Oxyspirura mansoni*, in southern Florida described in this paper include, in addition to those already noticed [*R.A.E.*, B, xvi, 132], experiments in which the intermediate host, *Pycnoscelus* (*Leucophaea*) *surinamensis*, L., was infected by artificial feeding on eggs of *O. mansoni* containing coiled embryos and on freshly voided faeces of fowls severely infested with eyeworm, showing that the time required for the larvae to reach the infective stage in the cockroach was 50–100 days. Eggs of *O. mansoni* may occasionally hatch in the intestinal canal of the fowl, but most of them pass from the body with the faeces. Should they be taken into the digestive tract of *P. surinamensis*, as would be possible in view of the indiscriminate feeding habits of the Blattid, the young larvae hatch and encyst in the abdominal cavity, where further growth and development take place. The cockroaches are readily eaten by fowls, and the larvae contained in them gain a position in the mouth, whence they pass into the eye through the naso-lacrymal duct. They may pass again through the naso-lacrymal duct into the mouth, when they wander about for a time and finally return to the tear-sac, where they lay their eggs on reaching sexual maturity. Live worms taken from the eye contained numerous eggs 48 days after infestation, and microscopic examination of the eye fluid and of the intestinal contents of diseased birds revealed the presence of eggs of the parasite after the same period.

Laing (F.). **The Cockroach. Its Life-history and how to deal with it.**—*Econ. Ser. Brit. Mus.* (*Nat. Hist.*), no. 12 (2nd edn.), 23 pp., 1 pl., 4 figs. London, 1930. Price 6*d*.

This revision of a pamphlet already noticed [*R.A.E.*, B, ix, 99] contains additional information on the life-history of the cockroaches found in Britain, and on measures of control, which include the use of a spray made by soaking $\frac{1}{2}$ lb. pyrethrum powder in 1 gal. paraffin for about two hours and decanting the liquid. Methyl salicylate or an essential oil may be added if a pleasant scent is desired. The liquid should be vapourised by using a fine nozzle on the sprayer. Carbon tetrachloride may be used in a similar way. The cockroaches may be trapped by an adhesive, such as those used for banding fruit trees or a mixture of resin and linseed oil, spread on pieces of cardboard with a bait in the centre.

Zernoff (V.). **L'immunité et les anticorps non spécifiques chez les insectes (chenilles de** *Galleria mellonella*).—*C.R. Soc. Biol.*, cvi, no. 3, pp. 151–153, 4 refs. Paris, 30th January 1931.

The results of experiments, which are briefly described, confirm those of other observers that neither immunity in caterpillars of *Galleria mellonella*, L., nor the bacteriolysins elaborated by the blood of immunised larvae are specific.

Uvarov (B. P.). **Insects and Climate.**—*Trans. Ent. Soc. London*, lxxix, pt. 1, pp. 1–247, 53 figs., 40 tables. London, April 1931. Price 21*s*.

This important review of the literature of the subject, which has been published by the Entomological Society of London with the assistance of the Empire Marketing Board, should be consulted in the original. It is divided into two main parts. The first deals with " The Physical Factors of Insect Life " and comprises sections on heat, humidity, other climatic factors and combinations of several factors. The second and larger portion is entitled " Weather, Climate and Insects " and deals with the following aspects of this problem : Relation of Weather to the Activities of Insects ; Daily and Annual Cycles ; Climate and Distribution ; Effect of Climate on Abundance ; and Climate and Weather in Economic Entomology. There is a very extensive and useful bibliography of over 1,150 titles, and an index to authors and a subject index are appended.

Patton (W. S.). **Insects, Ticks, Mites and Venomous Animals of Medical and Veterinary Importance. Part II.—Public Health.**—Med. 8vo, viii+740 pp., 57 pls., 388 figs., 1 chart. Liverpool School of Tropical Medicine, 1931. Price 22*s*. 6*d*.

The second portion of this extensive work [*R.A.E.*, B, xvii, 230] is devoted to the insects that are directly or indirectly associated with man himself or his habitations and surroundings. The first 359 pages follow the same plan as that adopted in the first volume and take the form of an outline of a course of lectures dealing with the classification and anatomy of insects in general, with special reference to those of importance in relation to public health.

The appendices comprise one entitled " The Dissection of the Alimentary Tract and Salivary Glands of a Mosquito," and a second one of considerable importance and occupying some 340 pages, dealing at length with household Arthropods and their control.

This volume is also illustrated with a number of excellent drawings, very many of which are original.

Boyd (M. F.). **An Introduction to Malariology.**—Demy 8vo, xiv+437 pp., 2 pls., 80 figs. Cambridge, Mass., Harvard Univ. Press ; London, Oxford Univ. Press, 1930. Price 25*s*.

This work contains a considerable amount of matter of interest to the medical entomologist. The first two chapters, which deal with the natural history of malaria and with malaria surveys, especially in the New World, give much useful data on the connection of Anophelines

with the disease. The remaining chapters deal wholly with these mosquitos and contain an up-to-date account of their anatomy, life-history and distribution, the last dealing with Anopheline surveys. A selected list of references is appended to each chapter.

GONGGRIJP (L.). **Gezondheidstoestand en gezondheidszorg op de kleinere Landbouwondernemingen op Java.** [Health Conditions and Health Care in the smaller Plantations in Java.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxx, no. 12, pp. 1248–1255. Weltevreden, 1st December 1930.

Two examples are recorded of plantations about three miles from the coast being seriously affected by malaria. Both were situated near small rivers, and in both cases the vector concerned was *Anopheles ludlowi*, Theo., which bred partly in brackish water along the coast and partly in the streams, even where the water was practically fresh. *A. aconitus*, Dön., a species that breeds in sunlit water as *A. ludlowi* does, was also concerned in the transmission of the disease. Dusting with Paris green and planting shade-trees on the banks of the streams were the measures recommended.

GINSBURG (J. M.) & FORMAN (L.). **Preliminary Studies on Causes and Remedies for Mosquito Breeding in Sewage Disposal Plants.**—*Sewage Works J.*, ii, no. 3, pp. 412–418. Reprint, *sine loco*, July 1930. [Recd. March 1931.]

The following is taken from the authors' summary and conclusions: An investigation, in which five disposal plants of both the sprinkling-filter and intermittent-sand-bed-filter types were used, was carried out with a view to studying the effect of various oil distillates and larvicides on the bacteriological and biochemical processes when sprayed on filter beds and sedimentation tanks to control mosquito breeding. Chemical and bacteriological analyses of the effluents were made before and after treatment. A study was also made of the various causes responsible for mosquito breeding in sewage plants and their permanent remedies.

The results obtained and the observations made suggest that most of the breeding-places encountered can be permanently eliminated by proper mechanical methods, and where this is not possible, a rapid and complete kill can be obtained by the application of furnace oil, light fuel oil or kerosene. Residue fuel oils, flux oils and heavy lubricating oils should not be used or only to a limited extent, because they may leave oil or tar residues on the sand beds and to a less extent on the sprinkling-filter beds, which might interfere with proper filtration and bacteriological activities. None of the oils tested exerted any detrimental effect on the bacteriological and biochemical activities in sewage disposal. Oils containing 5 per cent. or more cresylic acid, which killed all the larvae and pupae in 15 minutes, caused a temporary reduction in the oxidation processes of the beds, but their normal function was restored within 5 days, and those containing 1·5 per cent. cresylic acid, which are toxic to the larvae and pupae in 30 minutes, affected the normal activities of the beds either not at all or very slightly. Neither of two pyrethrum larvicides in the dilutions tested, which were toxic in 2 hours or less, showed any influence upon the activities of the sewage.

del Ponte (E.). **Anophèles du haut Parana.**—*C.R. Soc. Biol.*, cvi, no. 5, p. 393, 1 ref. Paris, 13th February 1931.

In addition to the species of mosquitos already noticed [*R.A.E.*, B, xvi, 146], *Anopheles* (*Chagasia*) *fajardoi*, Lutz, and *Lutzia bigoti*, Bellardi, are recorded for the first time from Argentina, where they were found in streams.

Shannon (R. C.). **The Environment and Behavior of some Brazilian Mosquitoes.**—*Proc. Ent. Soc. Wash.*, xxxiii, no. 1, pp. 1–27, 16 refs. Washington, D.C., 1931.

As a result of an investigation on the mosquitos of the middle coastal States of Brazil, the numbers of species belonging to the different genera are compared with those occurring in Brazil as a whole and in various other American countries. A list is given of the 86 identified species found, showing the larval habitats. It is pointed out that the larvae of each are more or less restricted to a special type of habitat and that the natural classification of habitats is in accord with the natural classifications of the family as based on larval and adult characters.

The environment of the mosquitos is discussed from the point of view of their biology and from that of their relation to man. In the first case, the species are divided naturally, according to the situation of the water, into those that breed in ground water, either natural (ponds, streams, etc.) or artificial (reservoirs, wells, etc.), and those that breed in containers, either natural (tree-holes, fallen leaves, etc.) or artificial (tanks, domestic utensils, etc.), or according to the condition of the water (flowing or stagnant, shaded or sunlit, etc.). For the majority of the species the situation appears to be the most essential factor in the selection of breeding-places, the condition of the water being of primary importance only in the case of a few species of the subgenus *Culex*.

In the second case, the mosquitos are artificially classified into urban or domestic species, which appear to be primarily dependent upon an environment afforded by man and may be found in houses in the centre of large cities ; facultative suburban species, which are less well adapted, but can readily exist under suburban conditions in both adult and larval stages ; and the strictly sylvan species, which are so completely unadaptable that they rapidly disappear from areas on which man encroaches. The food-preferences of adult mosquitos and the time of day at which they are active are very briefly discussed.

Gil Collado (J.). **Datos actuales sobre la distribución geográfica de los Culícidos españoles.** [Present Data on the geographical Distribution of Mosquitos in Spain.]—*Eos*, vi, no. 4, pp. 329–347, 4 figs. Madrid, 22nd December 1930.

Of the Anophelines recorded in this survey, which includes some biological notes, *Anopheles maculipennis*, Mg., is the most common and is found everywhere. Its typical form is nearly always associated with the variety *atroparvus*, van Thiel, and investigations are being made to ascertain the correctness of Swellengrebel's view that this is the variety that is the vector of malaria [*cf. R.A.E.*, B, xviii, 52, 228, etc.]. *A. bifurcatus*, L., is much rarer, though probably of universal distribution. *A. algeriensis*, Theo., was observed only in Granada,

in the open, and only two records exist of *A. plumbeus*, Steph., one being doubtful. *A. hyrcanus*, Pall., is usually confined to the rice-fields of the Mediterranean coast. *A. hispaniola*, Theo., appears to be limited to the mountain zones of central and southern Spain, but seems to be increasing. It breeds in clear, constantly renewed water and hibernates in the adult stage, the number of generations a year varying greatly according to the locality. *A. superpictus*, Grassi, has been found in Murcià, Córdoba, and Huelva. Among the other mosquitos recorded, *Aëdes argenteus*, Poir., occurs only on the coast.

PECORI (G.) & ESCALAR (G.). **Relazione sulla campagna antimalarica dell'anno 1929.** [Report on the anti-malarial Campaign in 1929 in the Government District of Rome.]—*Riv. Malariol.*, ix, no. 5, pp. 479–549, 14 figs., 1 map, 2 diag. Rome, 1930. (With Summaries in Italian, p. 659, French, p. 661, English, p. 663, German, p. 665.)

This report follows the same lines as previous ones [*R.A.E.*, B, xviii, 54, etc.]. In 1929 the first males of *Anopheles maculipennis*, Mg., occurred late (27th April) and the last ones on 29th November. Dusting with Paris green and oiling were again used against the larvae. The numbers of *Gambusia* distributed were over 116,000 ; this fish could not be established in waters rich in carbonic acid. Trout, which were experimentally bred in three ponds, have some value against the larvae. *Lemna* was collected and placed in various wells and ponds, and those in which it developed remained free from larvae. The value of stabled animals in protecting houses from invasion by *A. maculipennis* was confirmed. The animal quarters should be situated between the dwellings and the mosquito breeding-places. They should be moderately humid and not too warm, and should not be ventilated. The apertures by which the mosquitos enter should not be exposed to the prevalent wind.

SCHWETZ (J.). **Le problème de la prophylaxie antipaludique dans les grands centres congolais en général et à Stanleyville en particulier.** —*Riv. Malariol.*, ix, no. 5, pp. 609–624, 13 refs. Rome, 1930. (With Summaries in Italian, p. 660, French, p. 662, English, p. 664, German, p. 666.)

This paper deals with the Anophelines of Leopoldville [*R.A.E.*, B, xvi, 215], Elisabethville [xv, 103], and Stanleyville [xviii, 209], with notes on the incidence of malaria in these localities and on possible measures against the vectors [xvi, 215].

SCHWETZ (J.). **Sur la répartition générale des Glossines dans la Province Orientale (Congo Belge). (Etude préliminaire.)**—*Rev. Zool. Bot. afr.*, xx, fasc. 2, pp. 186–199, 1 map. Brussels, 15th January 1931.

The following species of *Glossina* are recorded from the Province Orientale of the Belgian Congo : *G. palpalis*, R.-D., and *G. fusca*, Wlk., which are ubiquitous ; *G. tabaniformis*, Westw., which is ubiquitous in the equatorial forest ; *G. morsitans*, Westw., and *G. fuscipleuris*, Aust., which are extremely rare, only being found on the eastern border

of the Province ; *G. pallidipes*, Aust., which is also found on the eastern border but is less rare ; *G. brevipalpis*, Newst., recorded only from the south-east of the Manyema District ; *G. newsteadi*, Aust., which is confined to Bas-Lomami ; and *G. severini*, Newst., which is extremely rare and was only taken in the Ituri forest.

SCHWETZ (J.). **Deux voyages d'études médicales et paramédicales dans le Bas-Lomami.**—*Ann. Soc. belge Méd. trop.*, x, no. 4, pp. 385–403, 1 map, 4 refs. Brussels, 31st December 1930.

An account is given of two surveys of the banks of the Lomami River, Belgian Congo, and its tributaries between Isangi and Obenge, undertaken from 30th May to 7th July 1928 and from 5th October to 5th November 1929. *Glossina palpalis*, R.-D., was found practically everywhere, but was irregularly distributed and appeared to increase in numbers in the higher reaches, where the river is narrower, the villages less numerous and the banks more densely wooded. *G. fusca*, Wlk., and *G. tabaniformis*, Westw., were also ubiquitous ; they were seldom captured during the middle of the day and were taken as readily along roads or where there were no paths, as along the river banks. *G. newsteadi*, Aust., was only found in two localities and seems to be confined to certain places in this region [*R.A.E.*, B, xviii, 237]. Sleeping sickness does not exist in Bas-Lomami above Yahisuli. In 1928, out of 8,086 natives in 28 river villages of the region between Loya and Isangi, 15 infected persons were found ; as the actual number of cases was probably double this figure, the rate was probably about 4 per mille. A list is given of the mosquitos taken, including *Aëdes argenteus*, Poir., *Anopheles mauritianus* var. *paludis*, Theo., and *A. gambiae*, Giles. The other blood-sucking Diptera encountered have already been dealt with [xix, 82].

SCHWETZ (J.). **Note préliminaire sur les moustiques de quelques régions de la Province Orientale (Congo Belge).**—*Ann. Soc. belge Méd. trop.*, x, no. 4, pp. 429–438, 4 refs. Brussels, 31st December 1930.

Lists are given of mosquitos captured in the following districts of the Province Orientale of the Belgian Congo : Kivu, Kibali-Ituri, Stanleyville and Aruwimi (Bas-Lomami between Obenge and Isangi). The mosquitos of the last-named district are discussed at greater length than in the preceding paper.

MACGREGOR (M. E.). **The Nutrition of Adult Mosquitoes : Preliminary Contribution.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiv, no. 4, pp. 465–472, 6 refs. London, 31st January 1931.

Experiments are being carried out to determine the food requirements of mosquitos for ovulation and to investigate the fate of *Plasmodium inconstans* when ingested by mosquitos other than those species that constitute its natural intermediate hosts. *Aëdes argenteus*, Poir. (*aegypti*, auct.) and *Culex pipiens*, L., are the species generally

used, and food requirements have been studied by permitting them to "bite" normally, by inducing them occasionally to "bite" through prepared animal membranes, and by artificial feeding with the capillary-tube "unsheathed proboscis" technique, described in a paper already noticed [*R.A.E.*, B, xviii, 119], in which the labium is detached from the labrum epipharynx. Only by "biting" (or its equivalent, obtained by the "unsheathed proboscis" method) is the mosquito able to draw the ingested fluid directly into the stomach, otherwise the primary collection of fluid occurs in the diverticula [*cf.* xviii, 23]. Thus blood is usually taken into the stomach, and other fluids, particularly those containing sugar, are carried to the diverticula.

The results of the experiments, up to the present, indicate that the requirements for ovulation in *A. argenteus* are the presence of sperm in the spermathecae and blood in the stomach, but that in the case of *C. pipiens* some additional factor is necessary that has not yet been determined. Once the stimulus to activity has been given, ovulation may continue after the sperm is exhausted, so that infertile eggs are laid. For the activation of the fat-body, the essential requirement seems to be the direct reception by the diverticula of a particular food (according to these observations, blood) after previous activity of the ovaries. The sudden decline in the incidence of primary malarial infections in malarious localities may thus be due to the entry of the infective blood meal into the diverticula prior to hibernation. The reaction of the diverticula is alkaline as opposed to that of the stomach, which is acid. In this connection it is possibly significant that highly infective avian blood, containing a high proportion of gametocytes of *P. inconstans*, has always failed to induce infection in the mosquito when fed in a manner ensuring its reception by the diverticula.

TRENSZ (F.). **L'index maxillaire d'*Anopheles maculipennis* et la théorie du zootropisme anophélien.**—*Arch. Inst. Pasteur Algérie,* viii, no. 1, pp. 1–70, 2 pls., 45 graphs, 75 refs. Algiers, 1930.

The author gives the details of his work on the maxillary index of *Anopheles maculipennis*, Mg., in Algeria, Italy, France and Spain, and discusses his results, which conflict with Roubaud's theory of zootropism. His conclusions have already been noticed from a short preliminary note [*R.A.E.*, B, xviii, 144].

BROUSSES (A.). **Contribution à l'étude du paludisme en région saharienne. Observations recueillies à Djanet au cours de l'épidémie de 1928–1929.**—*Arch. Inst. Pasteur Algérie,* viii, no. 1, pp. 77–84, 3 pls., 1 map. Algiers, 1930.

An account is given of an outbreak of malaria in a small oasis in southern Algeria during 1928. The Anophelines collected were *Anopheles hispaniola*, Theo., and *A. broussesi*, Edw. [*R.A.E.*, B, xviii, 106]. Malaria in this region appears to correspond to the abundance of mosquito breeding-places, which is determined by the annual rainfall. The rarity of rainfall explains the long periods of apparent disappearance of the disease, the infrequent outbreaks, and their short duration. The absence of rainfall for several years constitutes a natural prophylactic measure. Thus the outbreak recorded occurred

after the rains in January 1928, but in the absence of further rainfall the breeding-places gradually disappeared, and in March-April 1929 Anopheline larvae were difficult to find. During the summer of 1929, only two cases of malaria were observed.

HACKETT (L. W.) & MISSIROLI (A.). **The natural Disappearance of Malaria in certain Regions of Europe.**—*Amer. J. Hyg.*, xiii, no. 1, pp. 57–78, 17 refs. Baltimore, Md., January 1931.

The authors discuss the disappearance of malaria from certain regions of Europe despite the persistence of *Anopheles maculipennis*, Mg. Theories to account for this are briefly reviewed, and it is pointed out that many of the conditions said to be associated with the disappearance of the disease along the northern limit of its distribution are not present or operative in certain areas in Italy, where uninfected districts are entirely surrounded by endemic regions. An attempt was therefore made to test certain hypotheses experimentally, and to measure and observe certain presumptive factors, with a view to throwing some light on the problem of how to restrict by conscious effort the transmission of malaria in those regions that are still endemic.

The following is taken from the authors' summary : The disappearance of malaria has been variously attributed to the development of immunity from infection in the local Anophelines, to the elimination of gametocytes through the effective treatment or enhanced natural resistance of a prospering community, or to an effective interruption of the contact between Anophelines and man. As regards the first two views, however, it has been found that Anophelines from non-malarious regions are infected by a suitable carrier in the same proportion as those from a malarious region ; and no account has ever been given of the reduction of gametocytes in a malarious population to a point where transmission can no longer take place in the presence of a sufficient number of Anophelines. As regards the third, an exact determination of the sources of blood meals of Anophelines captured in typical malaria-free localities showed that the attractiveness of domestic animals for *A. maculipennis* in such regions is at least fifty times that observed in the malarious regions studied. The consequent dissociation of Anophelines from man is sufficient to explain the cessation of malaria transmission.

The causes of this dissociation were studied experimentally in an isolated farmhouse. The results show that the type of shelter in which a food-supply is available has little influence on the behaviour of *A. maculipennis*, but that its movements and food-preferences are largely determined by an instinctive attraction (tropism) towards the species of animal on which it habitually feeds. This attraction appears to be exerted through an odour of the animal or animals in question. It appears that *A. maculipennis* has little tendency to return to the quarters where it has previously obtained food, and that it is not immobilised for long by the presence of an abundant source of nutrition. It is not diverted from an accustomed food-supply by the comfort of an ideal shelter. It is concluded that, given a very large production of *A. maculipennis* with the presence of continually stabled domestic animals in sufficient numbers to provide an unlimited food-supply, a preponderant strain of zootropic mosquitos (which are attracted strongly by the odour of domestic animals but not by that of man)

may be obtained in a given area as a result of prolific breeding over a period of years [*cf. R.A.E.*, B, xix, 68]. This preponderance will eventually reach a point where man is bitten so infrequently as to render the transmission of malaria virtually impossible.

RAMSEY (G. H.). **Yellow Fever in Senegal with special Reference to the 1926 and 1927 Epidemics.**—*Amer. J. Hyg.*, xiii, no. 1, pp. 129–163, 3 fldg. maps, 37 refs. Baltimore, Md., January 1931.

The occurrence of yellow fever in Senegal is discussed at length, together with factors, such as climate, the distribution of population and the occurrence of *Aëdes argenteus*, Poir. (*aegypti*, auct.), that have a direct relation to the epidemiology of the disease. Even in the coastal towns during the winter, temperatures are sufficiently high to permit the survival of *A. argenteus*, though they are low enough greatly to diminish its breeding and activity; yellow fever could therefore persist in the colony throughout the year. On the other hand, the population does not appear to be distributed in such a way as to maintain in any one locality a constant supply of individuals susceptible to yellow fever, so that the colony should probably be regarded as a potentially epidemic rather than an endemic area.

DAVIS (N. C.) & SHANNON (R. C.). **Studies on Yellow Fever in South America. Attempts to transmit the Virus with certain Aëdine and Sabethine Mosquitoes and with Triatomas (Hemiptera).**—*Amer. J. Trop. Med.*, xi, no. 1, pp. 21–29, 6 refs. Baltimore, Md., January 1931.

In the experiments described, *Aëdes fluviatilis*, Lutz, was found to be a fairly efficient carrier of the yellow fever virus under laboratory conditions in Brazil, using monkeys (*Macacus rhesus*) as experimental animals. In 11 trials there were at least 8, and probably 9, infections, with 3 deaths following bites, and 4 deaths following injection, of these mosquitos. In one case, a fatal infection was produced by the feeding of three individuals. This species is not domestic, and its habitat and behaviour in nature suggest that in few localities could it be an important factor in the dissemination of yellow fever. In 5 feeding and 5 injection experiments with *A. taeniorhynchus*, Wied. [*cf. R.A.E.*, B, xviii, 166], one fatal infection and one non-immunising fever followed the bites, and one fatal infection and three fevers (two immunising) followed the injections. It thus appears to be a relatively inefficient vector, but its abundance and vicious biting habits may make it a factor in transmission if cases of yellow fever should occur within its range at the proper season.

No infections were obtained with *Wyeomyia bromeliarum*, Dyar & Knab, *W. oblita*, Theo., or *Limatus durhami*, Theo., either by bites or by subcutaneous injection. The few experiments in which *Triatoma megista*, Burm., was used gave inconclusive results. It is practically certain that no transmission of the virus took place in two feeding experiments. It is believed that the virus remained alive for one week in the bodies of the bugs, and that in one case a febrile reaction following their injection was true yellow fever.

Davis (N. C.). **The Transmission of Yellow Fever. On the Possibility of Immunity in** *Stegomyia* **Mosquitoes.**—*Amer. J. Trop. Med.*, xi, no. 1, pp. 31–42, 3 refs. Baltimore, Md., January 1931.

The following is largely taken from the author's summary of experiments with *Aëdes argenteus*, Poir. (*aegypti*, auct.): Mosquitos taken in houses in São Salvador, Brazil, did not produce yellow fever when injected into monkeys (*Macacus rhesus*). They were taken in the absence of recognised cases of the disease in an attempt to obtain information as to the persistence of the virus in the community. Mosquitos that had digested a meal of immune blood did not give rise to immunity when injected into or fed upon monkeys. Those that had digested one or more meals of immune blood became infective after feeding on an infected animal. In mosquitos that had digested a meal of infectious blood, the ingestion of immune blood had no influence on the subsequent development of infectivity. Two batches of mosquitos fed on a mixture of infectious blood and immune serum did not become infective, but the mixture itself produced yellow fever when injected directly into a monkey [*cf.* next paper]. A similar mixture, with saline solution substituted for the immune serum, proved infectious on direct inoculation and gave rise to infectivity when ingested by two batches of mosquitos. Mosquitos that were given an interrupted feed, first on an immune and immediately afterwards on an infected monkey, became infective, but a similar batch of mosquitos fed first on an infected and then on an immune monkey produced no infection when injected into another monkey; this animal, however, was subsequently found to be immune from a test dose of the virus.

Hindle (E.). **The Transmission of Yellow Fever.**—*Lancet*, 1930, pp. 835–842, 21 refs. London, 18th October 1930. (Abstract in *Trop. Dis. Bull.*, xxviii, no. 4, pp. 285–286. London, April 1931.)

This paper contains records of numerous experiments on the transmission of yellow fever carried out during the past two and a half years at the Wellcome Bureau of Scientific Research. In experiments with *Aëdes argenteus*, Poir. (*aegypti*, auct.), it was found that the incubation period before the mosquito becomes infective may be as short as 9 days at a constant temperature of 28° C. [82·4° F.] or may be prolonged indefinitely at low temperatures. Thus a mosquito that has ingested virus does not become infective at a temperature of 10–15° C. [50–59° F.], but will become so if after several weeks the temperature is raised to 28° C. On the other hand, a mosquito that has become infective retains its infectivity by bite even if kept at a temperature as low as 10–15° C. It may become infective if kept at 18° C. [64·4° F.], but the incubation period is very prolonged. As regards the proportion of mosquitos becoming infected after feeding on an infected monkey [*Macacus rhesus*], in one experiment at 28° C. out of 11 mosquitos 5 (or 6) became infective, and in the remainder the infection died out. A fatal infection was produced by the bite of a mosquito 118 days after it had been infected, and there seems no doubt that once infected it generally remains so for the duration of its life. The inoculation of eggs laid by infected mosquitos, and also of larvae, pupae and adults developing from such eggs, gave uniformly negative results, and it seems almost certain that infection is not

hereditary. With reference to the passage of the virus from one mosquito to another during mating [*R.A.E.*, B, xvii, 237], the author found that infection was due to a surface contamination of the insects' bodies with infected faeces and was removable by washing. Consequently these cases are considered to have no bearing on the persistence of the disease in nature.

Experiments with immune serum and virus showed that the loss of infectivity to mosquitos, which generally occurs after 1–3 days of fever, is due to the development of immune bodies in the blood and not to the disappearance of virus. Mosquitos fed on a mixture of virus and immune serum failed to become infected, and yet these mixtures were infective when inoculated into monkeys. In yellow fever cases the blood ceases to be infective to mosquitos as soon as the concentration of immune bodies reaches a certain level, but the virus does not disappear from the blood till much later. The ingestion of immune serum was found to have no effect on the infection once established in the mosquito, and infected mosquitos remained infective after having been fed on immune blood [*cf.* preceding paper].

PHILIP (C. B.). **List of Mosquitoes collected in Nigeria, West Africa, incidental to Research on Yellow Fever.**—*Proc. Ent. Soc. Wash.*, xxxiii, no. 2, pp. 44–47, 3 refs. Washington, D.C., 1931.

A list is given of mosquitos taken in Nigeria in connection with the study of endemic yellow fever, showing their abundance and indicating the species that have been experimentally implicated in the transmission of the disease [*cf. R.A.E.*, B, xviii, 198, etc.].

SIMMONS (J. S.), ST. JOHN (J. H.) & REYNOLDS (F. H. K.). **Experimental Studies of Dengue.**—*Philipp. J. Sci.*, xliv, no. 1–2, pp. 1–251, 3 pls., 67 figs., num. refs. Manila, January-February 1931.

A comprehensive account is given of observations and experiments carried out in the Philippine Islands since 1928 on the various aspects of dengue fever, including its epidemiology, the insect vectors and methods of transmission, the causal organism, the symptoms of the disease in man and prophylactic vaccination, which has not so far been successful.

Two important vectors, *Aëdes argenteus*, Poir. (*aegypti*, auct.) and *A. albopictus*, Skuse, are known to be prevalent in the Philippines, and the disease shows a seasonal variation corresponding to changes in their numbers ; these in turn are influenced by variations in the rainfall and temperature. Experiments with *A. argenteus* to determine the length of time that the blood of an infected person remains infective to it, the length of the incubation period within the mosquito and the period during which it remains infective, confirmed the results of other workers [*R.A.E.*, B, xiv, 124]. Continued experiments on the ability of *A. albopictus* to transmit the disease confirmed those already noticed [xviii, 146]. Negative results were obtained with *Culex fatigans*, Wied. (*quinquefasciatus*, Say). The virus of dengue was transferred mechanically by 125 individuals of *A. argenteus* and by 54 of *C. fatigans*, which were interrupted while feeding on infected blood and immediately allowed to complete their meal on susceptible persons. Experiments in which only 8, 12 and 21 mosquitos were used gave negative results, indicating that relatively large numbers

are necessary for mechanical transmission, which probably, therefore, rarely occurs in nature. Dengue virus from infected examples of *A. argenteus* rubbed into normal and excoriated skin of susceptible human beings failed to produce infection, so that contamination from crushed insects is probably not a factor in the natural spread of the disease. The fact that hereditary transmission does not occur [xiv, 124] was confirmed experimentally. Adult females of *A. argenteus* reared from larvae that had lived in water contaminated at intervals by the addition of small amounts of macerated infective adult mosquitos failed to transmit the disease. No positive evidence was obtained to indicate that normal mosquitos are infected by feeding on food or water contaminated by living infected mosquitos. The virus, has, however, been transferred to normal mosquitos by feeding them on macerated infected mosquitos, suspended in normal blood, using not less than 5 infective mosquitos to each cubic centimetre of blood. The virus apparently retains its virulence for man after the initial passages from mosquito to mosquito, a period of more than seven days being required before mosquitos that had ingested the virus could transmit the disease. It was demonstrated that dengue can be transmitted to monkeys (*Macacus* spp.) by the bites of infected mosquitos; the virus multiplies in their blood without producing recognisable typical changes in the temperature or leucocyte counts. At some time between the third and ninth day after infection, the virus may be passed to other monkeys by blood inoculation, or may be transferred through mosquitos to other monkeys or man. These observations indicate that monkeys may be a natural reservoir of the virus in endemic tropical localities, and are, therefore, of importance in considering the epidemiology of the disease.

DE OLIVEIRA CASTRO (G. M.). **Sur la transmission de l'épithélioma contagieux par les moustiques.**—*C. R. Soc. Biol.*, cv, no. 29, pp. 316–318. Paris, 1930.

In an experiment in Brazil, a single female of *Culex fatigans*, Wied. (*quinquefasciatus*, Say), fed on a chicken infected with contagious epithelioma (fowl-pox), transmitted the disease to two normal chickens bitten three days later, the incubation period in the latter being 11 days [*cf. R.A.E.*, B, xviii, 127]. A third chicken inoculated with the faeces of the same mosquito developed the disease 10 days later.

VOGEL (R.). **Beobachtungen über die Papatacimücke** (*Phlebotomus papatasii* **Scop.**) **in Kleinasien (Dipt., Psychod.).** [Observations on *P. papatasii* in Asia Minor.]—*Z. wiss. InsektBiol.*, xxv, no. 10, pp. 190–193, 2 refs. Berlin, 31st December 1930.

In observations made in the summer of 1926 in Asia Minor, *Phlebotomus papatasii*, Scop., which was the only sandfly found, was widely distributed. Smyrna, though still largely in ruins following the Greco-Turkish war, did not show the increase of sandflies and consequent sandfly fever that would be expected, probably because of the strong sea-winds. Whereas in the Balkans sandflies usually do not occur above about 2,000 ft., they were common in Anatolia at about 3,000 ft., when local conditions were favourable. At Jachschehan *P. papatasii* was numerous in the open, and swarms attacked horses at nightfall.

It is possible that the land-tortoise, *Testudo ibera*, and the lizard, *Ophiops elegans*, are normal hosts. Natural enemies include bats, birds, and lizards, especially the house gecko, *Hemidactylus turcicus*.

MALDONADO (A.). **Rôle probable de quelques plantes caractéristiques de la région verruqueuse sur l'étiologie de la verruga de Pérou.**—*Bull. Soc. Path. exot.*, xxiv, no. 1, pp. 27–28. Paris, 1931.

On examination of the flora of certain river valleys in Peru, it was found that two plants, *Jatropa basiacantha* and *Orthopterygium huaucui*, were characteristic of localities where verruga occurs. It is suggested that they may act as reservoirs of the causal organism and that the species of *Phlebotomus* that transmit the disease [*cf.* *R.A.E.*, B, xvii, 189] may feed on the latex in them, a theory that explains why these sandflies are so abundant during the rains (January to April) when the growth of the plants is most luxuriant.

FLETCHER (T. B.) & SEN (S. K.). **A veterinary Entomology for India, Parts XII-XIII.**—*J. Cent. Bur. Anim. Husb. Dairying India*, iv, pt. 3, pp. 90–104, 2 pls. ; pt. 4, pp. 127–138, 5 pls. Calcutta, 1931.

These parts deal individually with the Oestrids recorded in the last one [*R.A.E.*, B, xix, 19], details of their bionomics and control being given from the literature.

PAPERS NOTICED BY TITLE ONLY.

OUDEMANS (A. C.). **Acarologische Aanteekeningen civ.** [Notes on Acari, civ.]—*Ent. Ber.*, viii, no. 175, pp. 135–140. Amsterdam, 1st September 1930. [Recd. 1931.]

MALKANI (P. G.). **Discovery of the oesophageal Stage Larvae of** *Hypoderma lineatum*, **Villers, in Indian Cattle. Preliminary Observations.**—*Ind. Vet. J.*, vii, no. 3, p. 240. Madras, January 1931.

BUCKLEY (J. S.), BUNYEA (H.) & CRAM (E. B.). **Diseases and Parasites of Poultry.**—*Fmrs.' Bull. U.S. Dept. Agric.*, no. 1652, 62 pp., 27 figs., 5 refs. Washington, D.C., January 1931. [Revision of no. 1337, *R.A.E.*, B, xii, 67.]

DIOS (R. L.) & NOPOFF (R.). **Les Ixodoïdés de la République argentine** [13 species with notes on their hosts].—*C.R. Soc. Biol.*, cvi, no. 5, pp. 393–394. Paris, 13th February 1931.

DOZIER (H. L.). **A new Scelionid Egg Parasite** [*Baeus latrodecti*, sp. n.] **of the Black Widow Spider** [*Latrodectus mactans*, F., in Haiti].—*Proc. Ent. Soc. Wash.*, xxxiii, no. 1, pp. 27–28. Washington, D.C., 1931.

DAVIS (N. C.). **A new Anopheline Mosquito** [*Anopheles shannoni*, sp. n.] **from Pará, Brazil.**—*Amer. J. Hyg.*, xiii, no. 1, pp. 345–348, 2 pls., 4 refs. Baltimore, Md., January 1931.

HERRICK (G. W.) & GRISWOLD (G. H.). **Common Insects of the Household.**—*Cornell Extens. Bull.*, no. 202, 53 pp., 31 figs., 20 refs. Ithaca, N.Y., N.Y. State Coll. Agric., January 1931. [*Cf.* *R.A.E.*, B, x, 11.]

Hoffmann (C. C.). **Los Simulidos de la region onchocercosa de Chiapas (con descripción de nuevas especies).** [The Simuliids of the Chiapas Zone where Onchocercosis occurs (with Descriptions of new Species).]—*An. Inst. Biol. Univ. Mexico*, i, no. 4, pp. 293–306, 15 figs. Mexico, 1930.

Two new species, *Simulium* (*Eusimulium*) *turgidum* and *S. pseudohaematopotum*, and a new race, *S. virgatum chiapanense*, are described from the Chiapas coffee zone of Mexico where *Onchocerca caecutiens* occurs, and are compared with *S.* (*E.*) *mooseri*, Dampf, *S.* (*E.*) *ochraceum*, Wlk., and *S. avidum*, Hoffmann, already recorded there [*R.A.E.*, B, xviii, 271]. These last three attack man. A method is described by which the larvae can be bred in containers in the irrigation channels of the coffee plantations, and by this means the hitherto unknown males of *S. mooseri* and *S. avidum* were obtained; their genitalia are illustrated.

Newman (L. J.), O'Connor (B. A.) & Andrewartha (H. G.). **Some Observations on the seasonal and regional Incidence of Blowflies in the south-west of Western Australia.**—*J. Dept. Agric. W. Aust.*, (2) vii, no. 4, pp. 592–600, 1 pl., 1 map. Perth, W.A., December 1930.

With the object of determining the species of blow-flies present in the south-western region of Western Australia, and their seasonal prevalence, trapping experiments were carried out in six localities from April 1929 to March 1930. *Chrysomyia rufifacies*, Macq., predominated in all districts throughout the warmer months (September to April), reaching its maximum numbers in January, but was scarce or completely absent during the colder months. It was the most uniformly distributed of all the species examined. *Lucilia sericata*, Mg., was most prevalent on the coast, only a few being recorded in inland districts during the spring and summer. At Perth it was present throughout the year, and it never constituted less than 15 per cent. of the total blow-flies captured. It reached its maximum in mid-winter and its minimum in mid-summer. At the only other coastal station under observation (which was 300 miles north of Perth), it was numerous in the spring and early summer, but completely absent during the late summer and autumn. *Calliphora australis*, Boisd., which appears to be the most important pest of sheep, made its appearance in May, reached its maximum in August-September, and gradually decreased to a minimum in mid-summer. It was absent from December to March at all stations except Perth. Characters distinguishing it from *C. stygia*, F., and *C. hilli*, Patt., which are not definitely known to occur in Western Australia, are indicated. An undescribed species of *Calliphora* was present throughout the year in certain inland districts, but was rarely found in Perth. It was most numerous in the winter and early spring, becoming less active and fewer in numbers as the summer approached. In most localities it disappeared entirely in the summer and reappeared in April or May. *Microcalliphora varipes*, Macq., was present in all the localities for 9 months in the year, but disappeared during the winter. It increased in numbers in spring and summer and reached its maximum in the autumn. Details of the catches at each station are given in tables, and the adult and larva of each of the blow-flies are very briefly described.

(18193) Wt P2/3550 1,700 6/31 H & Sp Gp 52

Bequaert (J.). **Notes on Hippoboscidae. 2. The Subfamily Hippoboscinae.**—*Psyche*, xxxvii, no. 4, pp. 303–326, 2 refs. Boston, Mass., December 1930.

The characters of the subfamily Hippoboscinae, with its single genus, *Hippobosca*, are described; the synonymy, distribution and hosts of the eight species recognised by the author are discussed, and a key is given to all except *H. fulva*, Aust. The species, with their principal hosts, are: *H. equina*, L., and *H. rufipes*, Olf., on domestic equines; *H. capensis*, Olf., on the domestic dog and wild carnivora; *H. fulva* and *H. hirsuta*, Aust., on antelopes; *H. maculata*, Leach, on domestic equines and cattle; *H. struthionis*, Jansen, on ostriches; and *H. camelina*, Leach, on camels.

Dunn (L. H.). **Rearing the Larvae of** *Dermatobia hominis* **Linn., in Man.**—*Psyche*, xxxvii, no. 4, pp. 327–342, 1 pl., 1 fig. Boston, Mass., December 1930.

A detailed account is given of the effects on man of infestation by the larvae of *Dermatobia hominis*, Say, six of which were obtained from eggs on a fly of the genus *Limnophora* in Panama and allowed to penetrate the skin of the author. The larvae left the body between 46 and 55 days later, and the adult flies emerged after a pupal period of 22–24 days passed in damp sand and sawdust.

Brumpt (E.). **Transmission d'***Anaplasma marginale* **par** *Rhipicephalus bursa* **et par** *Margaropus*.—*Ann. Parasit. hum. comp.*, ix, no. 1, pp. 4–9, 13 refs. Paris, 1st January 1931.

The author describes experiments carried out in Paris during the period 1923–25. Larvae of *Boophilus* (*Margaropus*) *annulatus microplus*, Can. (of Brazilian origin), from females fed on cattle infected with experimental anaplasmosis, transmitted the disease to a healthy animal, as was subsequently demonstrated by the negative result of a superimposed infection from the same source, and by the fact that a calf inoculated with its blood showed typical symptoms of the disease. Adults of *Rhipicephalus bursa*, C. & F., that were the offspring of ticks from Morocco and had been fed as larvae and nymphs on an animal infected with *Anaplasma marginale*, *Piroplasma bigeminum*, *Theileria mutans* and *T. annulata*, transmitted the first two only. *A. marginale* was observed in the blood, but the presence of *P. bigeminum* was only demonstrated when both infections were produced in a calf inoculated with blood from the infected animal.

Transmission of anaplasmosis by ticks took place when the average temperature was 14–16° C. [57·2–60·8° F.], a fact that shows that temperature has not the importance in this connection attributed to it by certain authors [*cf. R.A.E.*, B, xii, 11].

Langeron (M.) & Nitzulescu (V.). *Phlebotomus larroussei* **n. sp. nouvelle espèce européenne de phlébotome.**—*Ann. Parasit. hum. comp.*, ix, no. 1, pp. 72–76, 3 figs., 2 refs. Paris, 1st January 1931.

A revision of a collection of females of *Phlebotomus* taken in France, on the basis of Adler and Theodor's system of identification [*R.A.E.*, B, xiv, 96], has led to the description of *Phlebotomus larroussei*, sp. n., from six individuals, five of which had previously been identified as *P. papatasii*, Scop., and one as *P. perniciosus*, Newst. [xi, 70]. Three of these had been observed biting during the day-time.

[BLAGOVESHCHENSKIĬ (D. I.) & PAVLOVSKIĬ (V. N.).] **Благовещенский (Д. И.) и Павловский (В. Н.). Zur Biologie und Bekämpfung von** *Hypoderma bovis* **Deg.** [On the Biology and Control of *H. bovis.* (*In Russian.*)]—*Rep. Appl. Ent.*, iv, no. 2, pp. 371–399, 5 figs., 50 refs. Leningrad, 1930. (With a Summary in German.)

An account is given of investigations in the spring and summer of 1929 on the bionomics and control of *Hypoderma bovis*, DeG., on cattle in the Novgorod Government, where this fly causes great loss, by reducing the value of the hides. Although 51·2 per cent. of the cattle were infested in 1929, with an average of five larvae to each infested animal, the percentage was lower than in 1928, owing to abundant rainfall. The heaviest infestation occurred among young animals. Of the total number of the larvae, over 97 per cent. were found in the back. Examination of the cattle early in the morning before they were driven to pasture, and again in the evening on their return, showed that about 86 per cent. of the larvae left the animals while they were grazing, the remainder doing so at night in the cattle sheds. The larvae were present in the backs of cattle for an average of 45 days and emerged between mid-May and early August, but chiefly in June. The pupal stage lasted 24–30 days at an average temperature of 13·5–25·4° C. [about 56–77° F.] and a relative humidity of 53–76 per cent., and 34–44 days at 10·2–21° C. [50–69·8° F.] and 60–96 per cent. humidity. In captivity, adults lived up to 8 days. In nature, the maximum flight and oviposition occurred in July and August. Animals of various colours were equally attacked, no preference being shown for light-coloured individuals [*cf. R.A.E.*, B, xviii, 101].

Various methods used for the control of *Hypoderma* are reviewed from the literature, and a table is given showing the comparative effectiveness of the different larvicides. Of those tested by the authors, 1 cc. of a saturated solution of cupric sulphate injected into the orifice of the warble, killed all the larvae in 5 days, but increased the size of the warbles and caused suppuration, which in many instances was very difficult to heal. Injection of a 10 per cent. solution of iodoform in sulphurous ether killed 97 per cent. of the larvae in 3 days. Owing to its greater simplicity in preparation and application, however, the authors recommend iodoform in vaseline, 1 : 5, which destroyed 78–90·7 per cent. in 5 days. The hair is clipped over the orifice of the warble and about 0·4 gm. of the ointment is applied with a spatula.

The relation of *Hypoderma* to "rose fever" is briefly reviewed. In experiments, crushing the larvae in the warbles, or subcutaneous injection of an emulsion of them had no effect on the animals, but intravenous injection of the emulsion caused severe anaphylaxis in three cases out of six.

[POMERANTZEV (B.) & BLAGOVESHCHENSKIĬ (D.).] **Померанцев (Б.) и Благовещенский (Д.). Versuchsanwendung von Arsenikpreparaten im Kampfe mit der Viehzecke,** *Ixodes ricinus* **L.** [Experiments on the Application of arsenical Preparations for the Control of the Cattle Tick, *I. ricinus.* (*In Russian.*)]—*Rep. Appl. Ent.*, iv, no. 2, pp. 401–420, 7 figs., 4 refs. Leningrad, 1930. (With a Summary in German.)

Details are given of experiments against *Ixodes ricinus*, L., in the summer of 1928 in the Novgorod Government, by dipping infested

cattle in solutions of sodium arsenite alone, containing 0·16 and 0·19 per cent. arsenic trioxide, or in similar solutions with an arsenic content of 0·14 per cent. but with the addition of paraffin and soap [*cf.* *R.A.E.*, B, ix, 84]. The cattle were examined 12, 36 and 60 hours after dipping, when the percentages of ticks killed were 40·5, 56·6 and 61·2, respectively, with the 0·16 per cent. concentration, and 57·6, 60·2 and 60·8 with the 0·19 per cent. The paraffin-soap emulsion was somewhat more effective, the percentages of mortality being 54·5 after 12 hours, 66·4 after 36, and 73·3 after 60 ; this was probably due to the insecticidal properties of the paraffin and the greater adhesiveness of the emulsion to the skin and hair of the cattle. It caused, however, severe injury to the skin of the animals treated, but this did not occur in individuals that had previously been dipped in sodium arsenite solution alone. The dips also decreased the reproductive capacity of the surviving female ticks.

In laboratory experiments to determine the effect of a dip containing 0·19 per cent. arsenic after the dipping of the host, ticks were submerged for ½–1 minute in the solution and then placed on woollen material that had been moistened with it. In one of the experiments 96 per cent. of the ticks died after 5 days, and in another 94 per cent. after 7, whereas the percentages of mortality after 12, 36 and 60 hours were similar to those in the field experiments. The authors believe, therefore, that in the field mortality 5–7 days after dipping would probably exceed 90 per cent.

WELLER (B.) & GRAHAM (G. M.). **Relapsing Fever in Central Texas.**—*J. Amer. Med. Ass.*, xcv, no. 24, pp. 1834–1835. Chicago, 13th December 1930. (Abstract in *Trop. Dis. Bull.*, xxviii, no. 4, p. 299. London, April 1931.)

This is the first definite record of the existence of tick-borne relapsing fever in the United States, the source of infection being a cave in the Colorado River valley containing large numbers of *Ornithodorus turicata*, Dugès. Three out of four boys who entered this cave and were bitten developed typical relapsing fever exactly six days later, and all suffered from three or more febrile attacks. One of the authors who entered the cave was also bitten and developed fever on the seventh day. The cave was frequented by goats, sheep and various wild animals, but had only rarely been visited by man, so the infection must have been maintained in some animal. Some of the ticks were fed on a rabbit, which became ill on the sixth day and died with numerous spirochaetes in its peripheral blood. These are briefly described.

ZINSSER (H.) & CASTANEDA (M. R.). **Studies on Typhus Fever. II. Studies on the Etiology of Mexican Typhus Fever.**—*J. Exptl. Med.*, lii, no. 5, pp. 649–659, 3 pls., 3 charts, 9 refs. New York, N.Y., 1st November 1930.

CASTANEDA (M. R.) & ZINSSER (H.). **Studies on Typhus Fever. III. Studies of Lice and Bedbugs** (*Cimex lectularius*) **with Mexican Typhus Fever Virus.**—*T.c.*, pp. 661–668, 2 charts, 4 refs.

In the first paper evidence is adduced in favour of identifying the virus of Mexican typhus fever (Brill's disease) with *Rickettsia* bodies observed in lesions in guineapigs infected with this disease. In the

second paper, experiments in the injection *per rectum* of lice [*Pediculus humanus*, L.] with infected material from guineapigs are described. They showed that the organisms can be carried for 10 days in these insects, and that a ground-up suspension of such lice is still capable of infecting normal guineapigs. Only 1 experiment out of 7 was successful, but this is considered to have been due to technical difficulties. It is not easy to keep the lice alive after the injections, since guineapig plasma and some of the tissues seem to exert a toxic action to which lice succumb although daily fed on immune subjects.

Further experiments showed that rickettsiae derived from infected guineapigs can survive for 10 days in bed-bugs (*Cimex lectularius*, L.) after intra-coelomic injection, and remain capable of causing infection by injection. The bed-bugs have also been infected by feeding on benzolised rats in the blood of which rickettsiae had been shown to be present. Injection of the organs of such bed-bugs 5 days after the last, and 9 days after the first, infecting feeds produced typical Mexican typhus in guineapigs. Some of these guineapigs subsequently proved to be immune from the European form of the disease. Attempts to infect normal guineapigs by allowing infected bed-bugs to feed on them or by rubbing the faeces into the uninjured skin have so far been unsuccessful ; it is pointed out, however, that man is obviously more susceptible to the disease.

KATAGAI (T.). **Experimental Observations on the Life-history and Blood-sucking Habits of** *Rhodnius prolixus* **from South America.** [*In Japanese.*]—*J. Med. Soc. Formosa*, no. 306, reprint 21 pp., Taihoku, 1930.

An account is given of over two years' breeding experiments with the South American Reduviid, *Rhodnius prolixus*, Stål, in Formosa, where it does not occur in nature. A female lays from 120 to over 1,270 eggs, with an average of 513, 1–38 at each oviposition, which may take place at any time during the year, but occurs particularly from May to September. In an experiment at temperatures of 22–33° C. [71·6–91·4° F.] 59·46 per cent. of the eggs hatched, after an incubation period of 11–19 days. The nymphal stages last 86–385 days, and the adults live for from 19 to over 500. The bugs suck the blood of various mammals and birds ; the adults feed more often than the nymphs, and the females take more food than the males, particularly in summer.

JAMES (S. P.). **Some general Results of a Study of induced Malaria in England.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiv, no. 5, pp. 477–525, 1 pl., 3 graphs, 7 charts. London, 13th March 1931.

This paper, which records the results of a study of induced malaria used for the treatment of general paralysis in England that have accumulated since the preliminary reports were published in 1926 [*R.A.E.*, B, xiv, 176, 207], contains much information of entomological interest. During 5½ years the strain of *Plasmodium vivax* used has not changed in morphological characters or virulence. The females of *Anopheles maculipennis*, Mg., employed are still caught in the adult stage in nature, as this appears to be the only way in which a sufficiently large number can be obtained on any day at all seasons of the year.

The difficulty of finding patients infective to Anophelines [*loc. cit.*] is exemplified in an endeavour to infect *A. maculipennis* with quartan

and malignant tertian parasites. Zygotes of *P. malariae* were found in four out of eight experiments but no zygote was found after the fifth day ; sporozoites were absent from the glands of all specimens dissected, and no infection resulted when many of the mosquitos surviving from the two batches in which zygotes were found were fed on healthy patients several times from the tenth day onwards. In the case of *P. falciparum*, negative results were obtained in 17 feeding experiments in England, and only one good " infector " was found among five selected cases in Rome. In certain cases patients who have recovered spontaneously from a primary attack of induced malaria have been found capable of infecting mosquitos during the fever-free interval preceding a recrudescence, but after spontaneous recovery from the recrudescence they are no longer infective, owing to the absence of a sufficient number of gametocytes. Further experiments with the three types of malaria parasites have confirmed the view that it is the " quality " rather than the quantity of gametocytes present that is important in the infection of mosquitos [*cf.* xiv, 207]. The method of judging the infectivity of a case of benign tertian malaria on the basis of the ex-flagellating male forms found is described. In experiments with *P. falciparum* and *P. malariae*, however, the finding of a considerable number of ex-flagellating male forms has not proved an invariable sign that *A. maculipennis* will become infected. The number of zygotes in infected mosquitos is increased by successive feedings, and zygotes in stages of development corresponding to the dates of feeding are found. Variations in infection of different individuals in the same batch of mosquitos have been attributed to various causes, but from experimental data the author is now of the opinion that the variations are too great to be attributed to any reason other than variations in receptivity in the individual mosquitos. It was thought possible that *A. maculipennis* in England had developed into a race refractory to *P. falciparum*, but on taking a batch to Italy it was found that 50 per cent. readily became infected when a " good infector " was available.

The period required for the development of sporozoites in the salivary glands of mosquitos kept in the bedroom of a house during the months of July-September was 15 days in two cases and 23 days in a third ; control batches kept in an incubator at a temperature of 78–80° F. dry bulb and 74–78° F. wet bulb became infective in nine days. Although for the purpose of obtaining a satisfactory supply of highly infected Anophelines it is thought advisable to allow the mosquitos to feed on human blood only, it has now been found that feeding on such substances as raisins and apple pulp is not deleterious to zygote production and development [*cf.* xiv, 207]. The number of zygotes found can seldom if ever be correlated with the amount of blood ingested. A comparison of the percentages of mosquitos that survived until they became infective during each of the different months over a period of nearly 7 years shows that there is a higher survival in some months than in others, and that from the point of view of the spread of malaria, a great abundance of adults in April and May is much less important than the presence of a few in August and September [xviii, 33].

It has been shown that failure to induce malarial attacks by the bites of infective mosquitos is not necessarily attributable to the insusceptibility of the patients, and it is suggested that not only must sporozoites be present in the salivary glands, but that they must be lying free in the common salivary duct at the time of biting if the infection is to be

successful. Some patients that have passed through one or more long attacks of induced malaria fail to react to subsequent infections with the same parasite, but such immunity confers no protection against other parasites or even against other strains of the same parasite, though in the latter case partial immunity may occur. With regard to the relation between the duration of the incubation period in man and the numbers of bites by well-infected mosquitos, it was found that when the number of bites was less than six, the incubation period was slightly longer than the average, but that when more than six bites were given, there was a tendency for the period to be shorter than the average. When 30 bites or more occurred, the incubation period was definitely shorter than the mean. The incubation period tended to be shorter than the average during April-October (particularly during August and September) and longer during the winter months. Provided that patients have not previously suffered from malaria, the desired attack has always been induced, although a third and even a fourth reinfection has sometimes been necessary.

With regard to the period during which individuals of *A. maculipennis* may remain infective, it was found that some mosquitos in one batch lived more than six months (23rd August 1926 to 1st March 1927) [*cf.* xiv, 207]. During the 10 weeks following the date on which the batch became infective, 54 patients were successfully infected, but during the last fortnight of the period sporozoites were scarce and finally absent. The batch was then successfully reinfected with the same strain of *P. vivax* and used for inducing malaria in three more patients. Some of the mosquitos remained alive and infective for nearly three months after their reinfection. In a separate experiment made with some members of the same batch, it was shown that mosquitos do not lose their infectivity by being kept for six weeks at a temperature between 3 and 6° C. [37·4 and 42·8° F.]. Observations on 107 cases of induced malaria indicate that the seasonal clinical incidence of the disease is about the same as that of natural benign tertian malaria in northern Europe and that the " spring rise " is due to recurrences in persons that had undergone a primary attack in September, together with primary attacks in persons with infections contracted in September that had remained latent throughout the winter [xviii, 52]. In cases infected by blood inoculation, true (long interval) relapses and recurrences do not occur, whereas they were observed in 50 per cent. of the cases infected by the bites of mosquitos.

HAMLYN-HARRIS (R.). **Mosquitos breeding in Tree Cavities in Queensland.**—*Bull. Ent. Res.*, xxii, pt. 1, pp. 51–52. London, March 1931.

An examination of 1,299 trees in the Brisbane area in midsummer revealed 196 cavities of which 64 contained mosquitos. Of these, *Aëdes argenteus*, Poir., constituted 17·1 per cent., *A. notoscriptus*, Skuse, 71·9, *A. argenteus* in association with *A. notoscriptus* 9·4, and *Culex fatigans*, Wied., 1·6. Although mosquitos were found in 64·7 per cent. of the cavities in *Poinciana regia* and in only 24 per cent. of those in *Ficus* spp., the greater number of the latter containing potential breeding-places renders them a greater actual menace. Lists are given of the species of trees in which larvae were found breeding and of those that give rise to cavities that seldom contain larvae. In parks, roadways, etc., trees situated in the vicinity of dwellings tend to contain *A.*

argenteus, whereas in the case of trees situated further away, *A. notoscriptus* was usually found in association with species of *Culicoides*, Chironomid and Syrphid larvae, and a few other insects. *A. notoscriptus* is often particularly noticeable in areas of bush that are apparently devoid of water, and systematic search has shown that in most cases it breeds in enormous rot-holes capable of holding several gallons of water, which evaporates slowly. All that is necessary to control breeding is to fill up such cavities with heavy soil.

Paradichlorobenzene is useful in controlling mosquitos breeding in *Bromelia* and places of a similar nature, including flower vases in cemeteries ; it has been equally effective in tree-cavities.

HARVEY (D.) & SYMES (C. B.). **Oxygen Absorption of natural Waters in Nairobi with Reference to Anopheline Mosquitos.**—*Bull. Ent. Res.*, xxii, pt, 1. pp. 59–64. London, March 1931.

The following is taken from the authors' summary : With certain exceptions, the samples of water containing Anophelines showed higher organic indices than those without. Particularly, it is noticeable that the series of samples in which very few or no Anophelines occurred showed lower indices consistently. Again with certain exceptions, the ratio of organic to inorganic matter in waters producing Anophelines has been lower than in waters in which no Anophelines were found. This ratio is particularly high in waters that have been consistently without Anophelines. Certain waters appear to be definitely and always attractive, others only partly so, and yet others seem never to be used for breeding. After a dry period, it appears that heavy washing rains result in the addition of considerable quantities of organic matter, and the organic index rises immediately. It falls as rapidly immediately afterwards.

KUMM (H. W.). **Studies on *Aëdes* Larvae in south-western Nigeria and in the Vicinity of Kano.**—*Bull. Ent. Res.*, xxii, pt. 1, pp. 65–74, 8 figs., 12 refs. London, March 1931.

A key is given to the larvae of 17 of the commoner species of *Aëdes* collected by the author in the vicinities of Kano, Ibadan and Lagos, the breeding-places of which are indicated, together with 7 additional species from Nigeria of which larval mounts were available, and their characters are also compared in a table. The larvae of *A. hirsutus*, Theo., *A. simulans*, N. & C., and *A. kummi*, Edw., are described. A list is also given of the mosquitos of this and other genera collected in various localities in Nigeria.

ADLER (S.) & THEODOR (O.). **A Study of the Sandfly Population in endemic Foci of Infantile Kala-azar in Italy.**—*Bull. Ent. Res.*, xxii, pt. 1, pp. 105–113, 2 pls., 2 figs., 9 refs. London, March 1931.

This study was carried out from the middle of July to the beginning of September 1929 in the neighbourhood of Naples and in Catania, which are the most important centres of visceral leishmaniasis in Italy and where both human and canine visceral leishmaniasis occur. Although on several occasions cases of the two diseases have occurred in the same house, human cases have been observed in houses where dogs were not infected. It is reported that the destruction of street

dogs in Catania in recent years has not affected the incidence of the disease in children [*cf. R.A.E.*, B, xix, 55]. In contrast to Assam, where cases in infants under 12 months old are rare, 9·5 per cent. of the cases in Naples and 13·3 per cent. of those in Catania are in infants under 12 months.

The sandflies encountered were *Phlebotomus papatasii*, Scop., *P. perniciosus*, Newst., the male and female of which are described, and of which *P. grassii*, Pierantoni [xiii, 152] is considered a synonym, *P. parroti* var. *italicus*, n., described from the male and female, *P. vesuvianus*, sp. n., described from the female only, and *P. sergenti*, Parr., which was found only in Catania.

In spite of the fact that Roubaud found that *P. perniciosus* fed more readily on man than on laboratory animals, in southern Italy it appears to be distinctly zoophilic, many more engorged individuals being found in stables in the neighbourhood of houses than in the houses themselves, even when sleeping rooms and stables were connected by open doors or windows. It feeds mainly in the early evening, and unless suitable shelter is available, it does not remain long in the room where it has fed. In catches carried out two or three times a day, the numbers of *P. papatasii* did not vary very much, but the numbers of *P. perniciosus*, which is apparently more photophobic than *P. papatasii*, were considerably less in the morning than in the evening, when they came out to feed. Dissections of 1,547 females comprising all five species showed no infection with *Leishmania*.

Analysis of the sandflies caught in infected houses and in houses free from the disease did not give conclusive evidence as to the species of the vector. *P. papatasii* and *P. perniciosus* were found together in both cases. In Catania, as in Naples, cases of infantile leishmaniasis occur mainly at or near the periphery of the town, where *P. papatasii* and *P. perniciosus* are the commonest biting insects and are far more numerous than in the centre. *P. vesuvianus* can be suspected as a carrier only because of its close relationship to *P. chinensis*, Newst. Its distribution does not correspond to that of the disease, for it was not found in Catania. *P. parroti* var. *italicus* can be excluded as a possible vector, for it seldom if ever bites man and feeds mainly on lizards.

During 1928 and 1929, individuals of *P. papatasii* were fed through membranes [xv, 54] on strains of *L. donovani* (*infantum*) from Naples cultured directly from human cases and on a strain isolated from a dog that had been inoculated from man. Individuals of *P. perniciosus* bred in the laboratory refused to feed through membranes. The results suggest that *P. papatasii* is not a good carrier of the strains used, for a carrier would be expected to give a much higher rate of infection with the concentrations of flagellates employed, concentrations that represent more parasites per feed than would be found in nature. Some strains of *L. tropica* from Palestine give almost 100 per cent. infection rate in *P. papatasii* fed on much lower concentrations. Thus *P. perniciosus* appears to be a more likely carrier. *P. papatasii* was also fed on two strains of *L. donovani* from India. With the Indian strains 37 per cent. of the sandflies became infected, as compared with 13·2 per cent. when Italian strains were used. On the other hand, the intensity of the infestation was greater with the Italian strains, the cardia being choked with flagellates in 8 out of 9 cases, whereas only 5 out of 34 positive cases infected with the Indian strains showed a moderate infection in the cardia. Moreover, infections with the Indian strains tended to die out progressively in sandflies, whereas those induced by

Italian strains did not. Both strains differed from a canine strain of visceral leishmaniasis received from Tunis, which produced a high infection rate in *P. papatasii*, the parasites ascending into the pharynx. Inoculation with this strain produced local lesions in mice, and local lesions in man were induced by inoculation of material from the tail of an infected mouse. Neither the Italian or Indian strains produced local lesions in mice.

MER (G.). **Notes on the Bionomics of** *Anopheles elutus*, **Edw. (Dipt., Culic.).**—*Bull. Ent. Res.*, xxii, pt. 1, pp. 137–145, 2 figs., 12 refs. London, March 1931.

Observations on the seasonal distribution of *Anopheles sacharovi*, Favr (*elutus*, Edw.) in Palestine confirm those of previous workers [*R.A.E.*, B, xviii, 225] that there are two distinct peaks, one in May-June and the other in October-November, the adults disappearing almost completely in August-September. During the last half of November and during December and January the number remains constant, but a second drop occurs in February-March. During this period only overwintering females are present, and they gradually disappear. The cause of the drop in June is not, however, clearly understood, and investigations were undertaken in an attempt to elucidate the problem. It was found that the fertility of the female is not constant. The average number of eggs laid reaches its maximum in May, a month earlier than the adult maximum is attained, drops to a low figure in July, and rises to a second smaller peak in August, so that the relation to the adult numbers no longer holds good. The generations before and immediately after hibernation show low fertility. The percentage of larvae that hatch from eggs laid at different periods of the year remains fairly constant.

Observations and experiments on the eggs of *A. sacharovi* in the laboratory and in the field proved that the presence or absence of air floats and their size and shape depend entirely on the temperature prevailing during the development of the ovaries [*cf. R.A.E.*, B, xii, 95 ; xiii, 109]. It is suggested that the function of the floats is to keep the eggs higher above the surface of the water and thus obtain optimum temperatures in the cold season by exposing them more to the rays of the sun, and that their loss is a protective adaptation against excessive heat and irradiation, the broad rim of the summer eggs keeping them more deeply immersed in the water.

Hibernation is only partial where feeding and flying are concerned but the suspension of egg-laying is complete. In 1929 the first females with fat-body reserves were observed in October, at an average temperature (23° C. [73·4° F.]) that corresponds to that of the first week in May, when there is a maximum activity of the adults. Sexual activity appears to be resumed in February at a considerably lower temperature, although reactivation seems to be brought about by a rise in temperature. The accumulation of fat-reserve, which is gradual, is closely associated with loss of sexual activity. At least 3–4 feeds appear to be necessary for the maximum deposition of reserve material. In October, when the average day temperature is 23°C., the feeds required must be frequent, because digestion of the blood is rapid and the females lose all their reserve fat in about eight days. The frequency of feeding

decreases with the progressive lowering of the temperature. Throughout the winter, females showing varying degrees of fat-reserves were observed, probably because fat-reserve accumulation and its consumption go on at the same time. A certain development of the eggs takes place during the hibernation period, but at no time during the winter are eggs brought to maturity. Maturation of the ova apparently occurs only after a blood feed.

KLIGLER (J.) & MER (G.). **Studies on Malaria : VI. Long-range Dispersion of *Anopheles* during the prehibernating Period.**—*Riv. Malariol.*, ix, no. 4, pp. 363–374, 4 figs., 6 refs. Rome, 1930.

These observations were undertaken to test previous ones on the long distance dispersion of *Anopheles sacharovi*, Favr (*elutus*, Edw.) in Palestine and were made in the area west and south of Lake Huleh in Galilee. North of the lake there is a large papyrus swamp in which *A. sacharovi* breeds in large numbers from April to October inclusive, and it abounds in certain localities in the plain and in the hills near which no breeding-places can be found [*R.A.E.*, B, xvii, 156] and there is a high incidence of malarial infection among these invading mosquitos [xvii, 250]. An investigation was therefore made to ascertain whether the assumed migration from the swamp takes place, and if so, whether *A. sacharovi* migrates by stages or covers the long distance to the hill villages direct. For this purpose, three villages were chosen: one in the swamp area, one in the plain, and one in the hills, the latter two being about three and nine miles, respectively, from the nearest breeding-place. It was found that during the prehibernating and hibernating periods the numbers of *A. sacharovi* occurring are in inverse relation to the distance. The mosquitos appear first in the village near the breeding area and last in the one farthest away, with a time interval of about two weeks between the first and the last.

In some females emerging even in early October a blood meal would seem to lead to the development of the fat-body, the ova remaining undeveloped. According to laboratory observations, at least four blood meals are required for maximum fat deposition [see preceding paper]. Apparently it is those females destined for hibernation that participate in the long distance migration, as is evidenced by the condition of the females in the villages at different distances from the breeding-places. The degree of fat and incidence of fat-containing females may even serve as a gauge of this distance. The high incidence of infected mosquitos in the hill village points to their infection prior to invading it. The relatively low incidence of infection in the plain village, associated with a high percentage of mosquitos that do not contain fat, suggests that mosquitos reach this village direct from the marsh and strengthens the assumption concerning the hill village. These observations explain the autumn epidemics at the latter and other places far removed from breeding centres and practically free from malaria during the rest of the year. Apparently the mosquitos destined for hibernation become infected during their first feeds, and the cysts mature during the long-range dispersion, sharp epidemics of short duration being thus produced. Females with developing ovaries rarely travel far, because of the need for laying the eggs that are maturing.

Brighenti (D.). **Gli anofelini delle Colonie italiane.** [The Anophelines of the Italian Colonies.]—*Riv. Malariol.*, ix, no. 4, pp. 429–433, 9 refs. Rome, 1930.

This is a survey of the records, taken from the literature, of the Anophelines in the various Italian colonies. In Libya, the dominant species are palaearctic and Mediterranean, with a few Ethiopian species. Two records of *Anopheles maculipennis*, Mg., from Italian Somaliland [*R.A.E.*, B, xiv, 215 ; xv, 1], are considered to be certainly due to misidentification of an Ethiopian species with spotted wings, probably *A. gambiae*, Giles.

Brighenti (D.). **Osservazioni sulla biologia dell'** *Anopheles sacharovi* **Favr.** [Observations on the Biology of *A. sacharovi*.]—*Boll. Zool.*, i, no. 1, pp. 27–30, 10 refs. Naples, February 1930.

Continuing his studies of *Anopheles sacharovi*, Favr [*R.A.E.*, B, xvii, 219], the author finds that this mosquito has 6 generations from May to September, the period of development being considerably lengthened (up to 25 days) during very hot summer weather and in autumn.

Brighenti (D.). **Sull' alimentazione delle Larve di** *Anopheles*. [On the Food of Anopheline Larvae.]—*Boll. Zool.*, ii, no. 1, pp. 27–31, 6 refs. Naples, February 1931.

Examination of the intestinal contents of 2,000 fourth instar larvae of *Anopheles maculipennis*, Mg., in the region of Ferrara showed that green algae, diatoms and phytoflagellates are very common in larvae from rice-field channels and are very rare, though still present, in those from marshes. The intestinal contents of larvae from drainage channels represent an intermediate stage between these two. Thus the greater or less resistance of the adults to infection by the malarial parasite that Alessandrini refers to the larval food factor [*R.A.E.*, B, xiv, 15] would appear to be due more to the amount of the food than to a different type of food.

[Shcherbakov (S. G.).] **Щербаков (С. Г.). On the Biology of** *Anopheles maculipennis* **in N.-Novgorod (from Observations in 1926).** [*In Russian.*]—*Trop. Med. Vet.*, viii, no. 1, pp. 56–60. Moscow, January 1930. [Recd. 1931.]

Observations in April-October 1926 in and near the town of Nizhniĭ-Novgorod showed that *Anopheles maculipennis*, Mg. (*claviger*, auct.) has three generations a year, July being the month when it breeds most freely. The seasonal occurrence of the various stages and its dependence on the temperature are discussed. The period required for the development of individual generations varied from 21 to 32 days. The presence of *Chara fragilis* and *Utricularia vulgaris* did not prevent the development of the larvae, and their numbers were in direct proportion to the quantity of *Spirogyra* present.

[AVERBUKH (I. Ya.).] **Авербух (И. Я.). Experiments in infecting Man with Quartan Malaria through the Bites of** *Anopheles maculipennis* **var.** *sacharovi*. [*In Russian.*]—*Rev. Microbiol.*, ix, no. 3, pp. 379–381, 4 refs. Saratov, 1930. (With a Summary in French.)

In December 1928, numerous females of *Anopheles sacharovi*, Favr, were fed on a patient suffering from quartan malaria, who had previously been treated with quinine for a short period. The engorged mosquitos were kept at a temperature of 19–22° C. [66·2–71·6° F.], and one was dissected each day, oöcysts of *Plasmodium malariae* being first found in the individual dissected on the 14th day. On the 36th day, three surviving mosquitos were fed on the author, who contracted quartan malaria 32 days later.

[SHLYAPINA (K. V.).] **Шляпина (К. В.). A few Results of the Examination of the Water Reservoirs of the Town of Saratov and its Environs with regard to the Presence in them of the Progeny of** *Anopheles maculipennis*. [*In Russian.*]—*Rev. Microbiol.*, ix, no. 3, pp. 383–390, 1 ref. Saratov, 1930. (With a Summary in French.)

In the course of investigations carried out in and near Saratov from 25th April to 29th October 1929, the results of which are tabulated, larvae and pupae of *Anopheles maculipennis*, Mg., were found in 55·6 per cent. of the permanent reservoirs of water examined and in 43·8 per cent. of the temporary ones. The chief reason for the absence of larvae and pupae from the latter was their drying up early in the season; in the case of permanent reservoirs, it was due to contamination of the water. A close relation exists between the conditions of the banks and the presence of the larvae, a shallow bottom and abundant vegetation, with sufficient exposure to the sun, being particularly favourable for them. In water in which optimum conditions prevailed throughout the summer, the larvae occurred till late in the autumn.

[KREMER (B. I.).] **Кремер (Б. И.). Contribution to the Method of determining the Blood in the Stomachs of Mosquitos.** [*In Russian.*]—*Rev. Microbiol.*, ix, no. 3, pp. 391–394. Saratov, 1930. (With a Summary in English.)

A positive reaction in the agglutination of fresh blood (not more than 3–4 days old) from the stomachs of mosquitos by means of standard human serum of the AB group indicates that the blood is animal, whereas in the case of human blood the reaction is negative. The accuracy of this method has been confirmed by a series of experiments.

[KREMER (B. I.).] **Кремер (Б. И.). On the Epidemiology of Pappataci Fever in the Crimea.** [*In Russian.*]—*Rev. Microbiol.*, ix, no. 3, pp. 395–400. Saratov, 1930. (With a Summary in English.)

Investigations carried out in the Crimea in the summer of 1929 showed that sandfly fever occurs only in places where *Phlebotomus papatasii*, Scop., is present, the infested districts being Sebastopol and its environs, and Bakhchisarai [*cf.* *R.A.E.*, B, xvii, 235; xviii, 116]. In Sebastopol the epidemic coincides with the period when the sandflies

are on the wing, lasting from June till the end of September, and reaching its peak in August. Newcomers are the first to be attacked, and immunity is acquired in 1–2 years. The sandflies are most numerous in low-lying parts of the town and in damp shady places with dense vegetation, protected from the wind; none was found at high elevations. Though they were abundant in inhabited houses, particularly in bedrooms, they never occurred in animal quarters, in sheds or among ruins. Moreover, all the females dissected contained human blood. It is probable, therefore, that the breeding-places occur somewhere near human dwellings, possibly in the cracks in the floor; in 1928 three larvae were found under a dog's kennel below the window of a room in which the adults were abundant. Unlike the sandflies that occur on the south coast of the Crimea, *P. papatasii* avoids natural as well as artificial light, becoming active only in complete darkness; in bedrooms it was invariably found in dark corners near the ceiling or behind pieces of furniture.

[Zasukhin (D. N.), Fedorov (N. S.), Bozhenko (V. P.) & Tiflov (V. E.).] **Засухин (Д. Н.), Федоров (Н. С.), Боженко (В. П.) и Тифлов (В. Е.). Data on the Fauna of Tabaninae (Diptera brachycera) of the South-east of the R.S.F.S.R.** [*In Russian.*]—*Rev. Microbiol.*, ix, no. 3, pp. 401–405. Saratov, 1930. (With a Summary in English.)

Very little is known on the transmission of trypanosomiasis of camels in the south-east of European Russia, where this disease is common. The relation of Tabanids and a few other blood-sucking Diptera to surra (*Trypanosoma evansi*) and other diseases is reviewed from the literature, and the importance of their study is emphasised. In south-eastern Russia the abundance of blood-sucking flies makes it impossible to keep cattle and horses in the fields in many districts where excellent pasture exists. A list is given of the species of the genera *Tabanus*, *Haematopota* and *Chrysops* collected in 1925, 1926, 1928 and 1929 in the Saratov and former Bukeev Governments, and on the Ural River, with indications of their distribution.

[Kadletz (N. A.) & Kubarev (M. V.).] **Кадлец (Н. А.) и Кубарев (М. В.). On the Question of Gastrophilomiasis. (Five Cases of Creeping Disease.)** [*In Russian.*]—*Rev. Microbiol.*, ix, no. 3, pp. 407–425, 9 figs., 34 refs. Saratov, 1930. (With a Summary in English.)

In July-August 1928, five cases of creeping disease in man, which are described, occurred within a fortnight in the Government of Samara. They were due to the larvae of *Gastrophilus*, possibly *G. intestinalis*, DeG., or *G. nasalis*, L.; the morphological characters of the larvae extracted are discussed. In the cases recorded, the patients had been in close contact with horses. The literature on the occurrence of *Gastrophilus* in man and the various modes of infection is reviewed, and a table is given comparing the chief biological characters of *G. intestinalis*, *G. nasalis*, *G. haemorrhoidalis*, L., and *G. pecorum*, F., and the appearance of the eggs and third instar larvae.

KALANDADZE (L.). **Zur Fauna der Stechmücken in Georgien UdSSR.** [On the Mosquito Fauna of Georgia.]—*Arch. Schiffs- u. Tropenhyg.*, xxxv, no. 2, pp. 110–113, 12 refs. Leipzig, February 1931.

The Anophelines mentioned in this paper have already been recorded from Georgia [*R.A.E.*, B, xv, 152; xvii, 157] with the exception of *Anopheles algeriensis*, Theo., found in 1929 and apparently very rare.

HEADLEE (T. J.). **Mosquito Control in New Jersey.**—*Proc. 55th Ann. Mtg. N.J. Publ. Hlth. Sanit. Ass. 1930*, pp. 17–25. New Brunswick, N.J. [1930.]

A brief account is given of the history and present status of anti-mosquito work in New Jersey, which has been steadily continued since 1899 and now covers an area of 150,000 acres of salt marsh and 500,000 acres of upland. The mosquito fauna in the protected areas has been enormously reduced, and the large sums of money expended in control work have been repaid more than one-hundred fold by the increases in taxable value of the territories so protected.

The principles involved in anti-mosquito work are discussed, and it is pointed out that the distance from the breeding-place at which towns are liable to become infested varies for the different species of mosquito. All known salt marsh species, with the possible exception of *Culex salinarius*, Coq., move from the place of breeding on winds of 10 miles or less an hour when these winds are of high temperature and relative humidity. Movements of 40 miles in New Jersey and 65 miles on the Gulf Coast of the United States have been determined. The extent of the movement is also influenced by the density of the brood concerned and the size of the area from which it comes. The fresh water swamp mosquito, *Aëdes vexans*, Mg. (*sylvestris*, Theo.), on the other hand shows a decided tendency to move from the area in which it breeds to densely populated areas, and its movement does not seem to occur in any marked relationship to wind currents. Movements of *A. vexans* as great as 10 miles have been repeatedly determined. *Culex pipiens*, L., normally does not show any considerable extent of movement, but when breeding intensively on a large area has been found to move 2½ miles in the direction of densely populated areas. Where great fresh water swamps stand close to densely populated areas, *A. vexans* overshadows all other mosquito problems except where salt marshes are also adjacent, when salt marsh mosquitos constitute the dominant problem. The habit of *C. pipiens* of breeding in every variety of domestic container in the midst of densely populated areas renders it a highly important species, and it may infest an area that is protected from salt marsh and fresh water swamp mosquitos.

HOWARD (L. O.). **The Work with Mosquitoes around the World in 1929.**—*Proc. 17th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1930*, pp. 7–30. New Brunswick, N.J., 1930.

Recent investigations carried on throughout the world on mosquitos, their control and their relation to disease are reviewed on the lines followed in previous years [*R.A.E.*, B, xvii, 243, etc.].

Gibson (A.). **Mosquito Suppression in Canada in 1929.**—*Proc. 17th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1930,* pp. 31–40. New Brunswick, N.J., 1930.

An account is given of mosquito investigations carried out during 1929 in various provinces of Canada, where the work is developing to a marked extent. In consequence of the dry summer, mosquitos were generally far less numerous than in 1928, when, owing to frequent heavy rains and floods, they were unusually prevalent.

Ginsburg (J. M.). **Studies of Pyrethrum as a Mosquito Larvicide.**—*Proc. 17th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1930,* pp. 57–72, 2 pls., 8 refs. New Brunswick, N.J., 1930.

Previous work with pyrethrum as a mosquito larvicide by various authors is discussed, including an unpublished report of studies carried out in Louisiana by C. H. Bradley, who secured a complete kill of the larvae of *Culex fatigans*, Wied. (*quinquefasciatus*, Say) in pans 3 ins. deep by the application of pyrethrum powder at the rate of 10 lb. per acre of water surface, 17½ lb. being required for *Anopheles quadrimaculatus*, Say. When, however, the powder was applied at the rate of 15 and 20 lb. on a swamp lake 8–12 ins. deep, only 20 per cent. of the larvae of *A. quadrimaculatus* and *C. inhibitator*, D. & K., were killed. He also reported a high toxicity of pyrethrum to frogs and fish. The discrepancy between the results secured with pyrethrum powder in the laboratory, where it is effective, and in the field, where it fails to give an adequate kill, is accounted for by the fact that the toxicity of pyrethrin is in direct proportion to its concentration, the amount of pyrethrum required increasing with the depth of the breeding-place. The results secured by previous investigators suggested that pyrethrum is not an efficient larvicide when applied as a powder in the open on water of considerable depth, but that when the active principle is extracted with organic solvents such as alcohol it possesses a higher toxicity than the powder itself, producing an efficient kill of the larvae and pupae in very high dilutions.

An investigation was conducted during the summer and autumn of 1929 with several preparations containing pyrethrum extracts. The results obtained suggested that alcoholic extracts are toxic to mosquito larvae and pupae (*Culex pipiens*, L., and *Aëdes sollicitans*, Wlk.) in concentrations of 1 : 20,000 (flower equivalent) and higher, but possess an even higher toxicity to fish. An attempt was then made to employ water-insoluble solvents for extracting the pyrethrum so that it would remain on the surface of the water sufficiently long to kill larvae and pupae without being diluted with water. The concentration applied could then be based on the surface area only, and a comparatively small quantity would be required. A light furnace oil of about 42° Bé., similar in its specifications to kerosene but unrefined, was selected as the solvent, the extract (1 lb. flowers to 1 U.S. gal. oil) being thoroughly emulsified with 34 per cent. water containing about 2–3 per cent. soap. The oil thus emulsified becomes temporarily miscible in water, but the globules soon separate out and come to the surface, carrying with them the pyrethrum extract. In the laboratory a complete kill of the larvae was secured in dilutions of 1 : 20 or lower within 48 hours, but only the lowest dilution (1 : 10) killed all the pupae within this period.

Most of the adults emerging from pupae treated with larvicide in low dilutions were unable to fly away, and their hind legs eventually became paralysed, indicating that most of the adults emerging within 48 hours after application will succumb to pyrethrin. In field tests a complete kill of larvae and pupae was secured in 24 hours with dilutions of 1 : 10–1 : 20, the destruction of pupae being more efficient than in the laboratory. At these dilutions the actual amount of oil, assuming that 50 U.S. gals. of spray are enough to cover an acre of water, is 1·65 U.S. gal. and 3·3 U.S. gals. per acre respectively. Emulsions of kerosene extracts of pyrethrum in concentrations sufficiently strong to kill larvae and pupae were not toxic to waterfowl, such as ducks, or to fish. The lasting quality of the larvicide is evidently not greater than that of light fuel oil, and spraying should be repeated at intervals similar to those of oiling. The actual cost of the ingredients of the larvicide is estimated at about 1½*d.* a U.S. gallon without the time and labour of extraction and emulsification, which should not amount to more than ½*d.* a U.S. gallon of diluted spray.

Miller (F. W.). **A Progress Report in an Investigation of the Egg-laying Habits of** *Aëdes sylvestris.—Proc. 17th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, **1930***, pp. 105–111. New Brunswick, N.J., 1930.

The results of laboratory breeding of eggs of *Aëdes vexans*, Mg. (*sylvestris*, Theo.) in soil samples taken from various types of likely breeding territory clearly indicate that eggs laid in one year may hatch throughout the following season, although most of the over-wintered eggs probably develop early in the year provided that the medium is wet. Large increases in breeding of *A. vexans* in permanent pools occurring during the season and after the spring broods emerge indicate that either eggs laid during the season hatch at least in part during that season, or that retardation conditions prevail, which, when released, permit previously retarded overwintering eggs to hatch. Close observations made during the summer of 1929 showed that although the eggs of *A. vexans* are not laid promiscuously, a wide divergence exists in the selection of egg-laying territory. Permanent pools, either in the open or in lightly wooded sections, and depressions on meadow land frequently inundated are apparently attractive for oviposition. The eggs are laid on the water surface and afterwards drop to the bottom. No breeding of *A. vexans* was observed in dark, heavily shaded pools or in polluted waters. Since eggs are frequently laid on the water surface, it appears possible that this mosquito will oviposit in artificial containers if favourable natural conditions do not obtain.

The collections showed that *A. vexans* reached two peaks, one on 20th July, and a second smaller one on 12th August. Five distinct broods incubated in 1929.

Rudolfs (W.). **What are the Prospects of eliminating Food of Mosquito Larvae from breeding Pools ?**—*Proc. 17th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, **1930***, pp. 113–123, 2 figs. New Brunswick, N.J., 1930.

The food-supply of mosquito larvae, which is more abundant in polluted than in non-polluted water, may consist of microscopic growth or

organic materials in solution and suspension, both sources of food being liable to fluctuate during the mosquito breeding season, owing mainly to changes in temperature. Microscopic growth can be killed with copper sulphate without affecting fish life, but a mixture consisting of 4·2 lb. chlorine and 0·4 lb. copper chloride to a million U.S. gallons of water is more effective. Certain fish, however, are very susceptible to chlorine, although goldfish, eels and perch are apparently unaffected by high dilutions. Organic substances (organic acids and colloids) can be precipitated by means of chemicals. Experiments conducted for the destruction of living larval food with about 80 chemicals and mixtures other than oils showed that these did not affect the mosquito larvae themselves within a short time of exposure.

As the substances likely to be responsible for mosquito breeding appear to be the organic acids formed in the decomposition of debris at the bottom of pools, it appears advisable to direct further studies toward finding the specific substances responsible for breeding ; arresting or changing the decomposition processes of the debris ; and absorbing or modifying the intermediate decomposition products.

HEADLEE (T. J.). **A further Contribution to Knowledge of the Influence of Summer Rainfall upon Mosquito Prevalence.**—*Proc. 17th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1930*, pp. 124–130, 4 graphs. New Brunswick, N.J.,1930.

In continuation of previous studies of the factors governing the incidence of maximum mosquito breeding [*R.A.E.*, B, xvii, 244], the diverse effect of rainfall is shown on *Aëdes vexans*, Mg. (*sylvestris*, Theo.), which hibernates in the egg stage in the soil and is ready to hatch at any time during the succeeding breeding season when water makes the conditions favourable, and *Culex pipiens*, L., which hibernates as an adult and starts in the spring with a greatly reduced number of adult females so that it must go through two or more generations before large numbers can be established. From the standpoint of mosquito breeding, which shows a wet year to be one in which rainfall throughout materially exceeds evaporation and a dry year to be one in which evaporation is fully equal to or exceeds the rainfall, the season of 1928 in northern New Jersey was wet and that of 1929 was much drier, the three wet peaks being widely separated and consequently affording little help to the multiplication of *C. pipiens*. In southern New Jersey, however, evaporation was fully equal to rainfall until the latter part of the season of 1928 and could not therefore be considered really wet ; the year 1929 was materially drier because evaporation exceeded rainfall except at the very beginning and end of the season.

Thus comparison of the results of mosquito breeding in 1928 and 1929 in northern New Jersey seems to afford a comparison between peak load and non-peak load conditions, whereas a similar comparison in southern New Jersey represents merely one between years neither of which exhibits peak load characteristics. A comparison between the excess of breeding places in 1928 over 1929 in northern and southern New Jersey showed that the difference in the number of breeding-places between a wet and a dry year is apt to be fully twice as great if the wet year is a peak load year.

[**Mosquito Control Work and Methods.**]—*Proc. 17th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1930*, pp. 41–51, 143–145, 145–147, 148–154, 155–164, 164–170, 170–184, 5 figs., 4 pls. New Brunswick, N.J., 1930.

Reports on local mosquito control work in several States in 1929 are given. In New Jersey, the season was marked by a greater degree of freedom in protected areas than has ever before been experienced, but in the unprotected districts annoyance was not greatly reduced by the dry weather conditions.

Other papers included are: The Importance of Back Yard Inspection to the successful Mosquito Control Campaign, by G. W. Eager (pp. 52–56); The economic Value of mechanical Equipment in various Phases of Mosquito Control. An Account of past and present Performances, together with a Forecast for the Future, by F. A. Reiley (pp. 73–81); The Value of educating the Public in the Mosquito Control Movement, by H. N. Prickitt (pp. 131–136); and Aquatic Plants as Factors in Mosquito Control and the Problem of the Food of Mosquito Larvae, by R. Matheson (pp. 81–101), much of the information contained in which has been noticed elsewhere [*R.A.E.*, B, xviii, 68].

de Buen (S.). **Algunas consideraciones sobre la conservacion del virus paludico en la epoca interepidemica.** [Some Notes on the Preservation of the malarial Parasite in the inter-epidemic Period.] —*Med. Países calidos*, iv, no. 1, pp. 19–23. Madrid, January 1931.

The occurrence of protracted incubation of benign tertain malaria in man has been experimentally demonstrated [*R.A.E.*, B, xviii, 52, etc.]. It is necessary to ascertain the importance of this factor in comparison with that of relapses in the preservation of the parasite (*Plasmodium vivax*) in the period between epidemics, for if cases of protracted incubation are common, it would explain the occurrence of the spring wave of malaria in spite of the treatment of infected persons, since in the absence of symptoms such cases would not be treated. An investigation has therefore been made under natural conditions in Spain, in districts where the first generation of Anophelines appears in mid-April, so that cases occurring from January to April inclusive may be regarded as having acquired infection in the previous year. Of 237 such cases, 32·4 per cent. had not shown symptoms in the previous year. In another group, the percentage was 30 for 150 children, and 69·3 for 33 adults, or an average of 37·1. It therefore seems that in Spain protracted incubation is of great epidemiological importance. An investigation of records, covering nine years and 1,078 people, showed that children up to 9 years of age are five times as susceptible to infection as adults, indicating that the greater frequency of prolonged incubation in adults is due to their greater resistance to *P. vivax*.

Elvira (J.). **Nota sobre la biologia del** *Phlebotomus perniciosus*. [A Note on the Biology of *P. perniciosus*.]—*Med. Países calidos*, iv, no. 1, pp. 52–53. Madrid, January 1930.

It is usually considered that *Phlebotomus perniciosus*, Newst., is a less domestic species than *P. papatasii*, Scop., but in the basin of the Ebro, both sexes in all stages, whether unfed, containing blood or ready to oviposit have been taken by day in dwellings.

Sinton (J. A.). **Notes on some Indian Species of the Genus** *Phlebotomus.* **Pt. XXVI.** *Phlebotomus eleanorae* **n. sp. Pt. XXVII.** *Phlebotomus bailyi* **n. sp.**—*Ind. J. Med. Res.*, xviii, no. 3, pp. 817–829, 3 pls. Calcutta, January 1931.

Phlebotomus eleanorae, sp. n., which belongs to the erect-haired group of sandflies [*cf. R.A.E.*, B, xvii, 30], is described from a single male among a collection of sandflies taken in human habitations in the Punjab. The male and female of *P. bailyi*, sp. n., which belongs to the group of *P. minutus*, Rond., are described from individuals taken in a dwelling at Kasauli, Punjab, at a height of about 6,000 ft. This species has a wide distribution in India, and as the individuals collected from the plains show slight but constant differences from those found in the hills, the name *P. bailyi* var. *campester* is proposed for them.

Shortt (H. E.). **Note on the Feeding Habits of** *Phlebotomus minutus.*—*Ind. J. Med. Res.*, xviii, no. 3, pp. 1047–1049, 2 refs. Calcutta, January 1931.

The author doubts the correctness of the statement of Lloyd & Napier that the species of the group of *Phlebotomus minutus*, Rond., used in their investigations [*P. babu*, Ann.] feeds on man [*R.A.E.*, B, xviii, 268], and describes an experiment in Assam in which sandflies of the same group were given two opportunities (totalling about 3 hours) to feed on man and subsequently one opportunity to feed on geckos. Many of the sandflies fed on the geckos, but in no case was man attacked.

Mukerji (S.). **On a new Species of Culicoides** (*Culicoides clavipalpis* **sp. nov.), with Notes on the Morphology of the Mouth-parts and Male Terminalia of an Indian Culicoides.**—*Ind. J. Med. Res.*, xviii, no. 3, pp. 1051–1058, 11 refs. Calcutta, January 1931.

A systematic survey of the blood-sucking insects of Calcutta and its environs was begun in 1929, special attention being given to the genus *Culicoides*. The species identified were *Culicoides peregrinus*, Kieff., *C. oxystoma*, Kieff., and *C. clavipalpis*, sp. n., which is here described. The external morphology of the mouth-parts and the structure of the male terminalia (hypopygium) of a species of *Culicoides* are discussed, and a tentative key to some of the Indian species of *Culicoides*, based mainly on the structure of the wing and spermathecae of the females, is appended.

Lorando (N.) & Chaniotis (N.). **Sur la dernière épidémie de dengue en Grèce. Faits cliniques et épidémiologiques.**—*Rev. Méd. Hyg. trop.*, xxiii, no. 1, pp. 23–31, 3 graphs, 14 refs. Paris, 1931.

After discussing clinical differences between the outbreak of dengue that occurred in Greece in 1929 and previous epidemics, the authors give the history of five small outbreaks confirming experimental evidence that *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) is the vector of the disease and that it is not transmitted by human excretions.

SÉGUY (E.). **Contribution à l'étude de la faune du Mozambique. Voyage de M. P. Lesne 1928-1929. 3e note.—Diptères (1re partie).**—*Bull. Mus. Hist. nat.*, (2) ii (1930), no. 6, pp. 645–656, 3 figs. Paris, 1931.

The mosquitos recorded include *Anopheles gambiae*, Giles (*costalis*, Theo.), *A. funestus*, Giles, *A. mauritianus*, Grp., *A. pharoensis*, Theo., *A. transvaalensis*, Cart., and *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.). Among other Diptera are three new Ceratopogonids, including one from Madagascar, and one new Tabanid.

CARPENTIER (G.). **Observation d'une épizootie de trypanosomiase dans le sud de la Perse.**—*Bull. Soc. Path. exot.*, xxiv, no. 2, pp. 89–93. Paris, 1931.

An account is given of an outbreak of trypanosomiasis (probably surra) that occurred among horses, cattle and other domestic animals in Persia during 1928–30. The insect vector is not known, but the inhabitants suspect Tabanids and certain smaller biting flies.

CARDAMATIS (J. P.). **Les espèces de moustiques en Grèce et tout particulièrement d'Athènes.**—*Bull. Soc. Path. exot.*, xxiv, no. 2, pp. 122–131, 4 figs., 11 refs. Paris, 1931.

Records of collections of mosquitos found in various parts of Greece, particularly Athens, since 1899 are reviewed. The Anophelines dealt with are: *Anopheles superpictus*, Grassi (including *palestinensis*, Theo., *cardamatisi*, Newst. & Cart., and *macedoniensis*, Cot & Hovasse, which the author treats as distinct species), *A. maculipennis*, Mg., *A. hyrcanus* var. *pseudopictus*, Grassi, *A. hyrcanus* var. *sinensis*, Wied., *A. bifurcatus*, L., *A. vagus*, Dön., *A. sacharovi*, Favr, *A. algeriensis*, Theo., and *A. atheniensis*, sp. n., which is described.

FULLER (C.) & MOSSOP (M. C.). **Entomological Notes on** *Glossina pallidipes*.—*Sci. Bull. Dept. Agric. S. Afr.*, no. 67, 27 pp., 1 fig., 11 refs. Pretoria, 1929. [Recd. 1931.]

Observations carried out during a stay of 8 weeks at Conjeni in Zululand showed that *Glossina pallidipes*, Aust., was exceedingly abundant along both banks of the White Mfolozi River during November, December and January, 1927–28. Although *G. pallidipes* has a fixed habit of living among trees, which it never voluntarily deserts, it may be carried long distances by traffic and be kept alive in captivity under artificial conditions although far from its natural environment. It readily crosses open spaces as much as 660 yds. in width. A series of observations and experiments in artificial feeding indicate that *G. pallidipes* may be stimulated to probe an animate or inanimate object by its odour, if it be a mammal or bird, or by the odour of a neighbouring mammal or bird; by the movement of the object, or of a neighbouring object; or by the heat of the object if the fly is already in contact with it or not more than about half an inch away.

Studies of the tropisms of *G. pallidipes* showed that when hunting in thickets it flies low; that it can be led to its quarry by the sense of smell; that in deep shadow a white calf was as much attacked as a speckled cow in proportion to its size, provided that the animals were close together, although in bright light the flies showed a preference for

black spots ; that guided by scent, the vision of the fly is in effect non-operative when it comes in contact with a strange object, and that the futile probing of lifeless objects is a reaction to scent ; and that *G. pallidipes* flies low in order to pick up the odour of its host, either as borne on currents of air or as left on the ground when it has moved along. When attracted by moving objects in open glades and wide spaces between trees, this fly seems to travel normally at 6–8 ft. above ground level. The scent of man, although definitely less attractive than that of animals, cannot be disregarded, and there is no doubt that the practically unclothed native is more attacked than the European, and is more distinctly visualised, owing to his dark colouration.

Studies of the sight of *G. pallidipes* show that when at rest it does not readily perceive a moving object that approaches it very slowly. The available evidence indicates that the distance at which a moving object is observed is greater than in the case of the house-fly, provided that the movement takes place between the insect and the source of illumination. Flies resting on wire screens were not, however, disturbed by movements that took place behind them, away from the source of illumination, unless such movements took place within a few inches of them. It is possible that *G. pallidipes* is relatively long-sighted as compared with other insects.

Experience with captive flies indicated that males feed more readily at intervals of 30 hours, and females at intervals of 42. The manner of feeding of the flies was observed minutely and is described in detail, indicating that the process is clearly under the psychic control of the fly. In the operation of probing, owing to the functioning of the labella, no moisture upon the skin is likely to be taken into the alimentary tract [*cf. R.A.E.*, B, xvi, 258], and it seems likely that any poison, to be effective, must be present in the blood-stream of the host.

Experiments were then carried out to determine the effect on *G. pallidipes* of contact with arsenical poison, and the weakest solution likely to produce a detrimental effect. The flies remained unaffected after being allowed to feed on a cow whilst wet with 0·1 and 0·24 per cent. arsenic trioxide (As_2O_3), and after being placed upon cotton-wool wet to saturation with 0·5 per cent. As_2O_3, double the strength of the strongest cattle dip. No flies showed any ill-effects up to 17 days after being allowed to feed on the finger when wrapped round with cotton-wool saturated with arsenical solution of the same strength, when both proboscis and feet came in contact with the wet poison. Further experiments in which the strength of the solution was increased up to 40 per cent. As_2O_3 showed that the death of the flies could be brought about, but only at strengths which would prove rapidly fatal to the animal. The flies died from the crippling effect of the arsenic upon the feet and not from its effect on the proboscis.

Preliminary experiments to determine the dose of arsenic that would be lethal to *G. pallidipes* when imbibed indicated that 1 volume of poison to 119 of drawn blood would suffice to kill. Nevertheless, flies fed upon a fowl 30–60 minutes after 1 cc. of 0·5 per cent. As_2O_3 had been introduced into its circulatory system remained entirely unaffected.

JOYEUX (C.) & PIERI (J.). **Hibernation du virus de la fièvre exanthématique méditerranéenne.**—*C.R. Acad. Sci. Fr.*, cxcii, no. 11, pp. 705–707. Paris, 1931.

In order to make further investigations on the transmission of Marseilles fever by *Rhipicephalus sanguineus*, Latr., in France [*R.A.E.*,

B, xix, 38], two lots of ticks were collected on 9th February 1931, one (101 males and 138 females) from a pound and the other (80 males and 105 females) from the walls of a house in which a case of the fever had occurred in the previous year. An emulsion of the first lot was inoculated into one person and of the second into another. In the first case there was hardly any appreciable reaction, but in the second, after 10 days, there was a rise in temperature, which reached 39·7° C. [103·4° F.], the fever lasting 8 days, and being accompanied by the usual characteristic eruption. *R. sanguineus* is, therefore, capable of harbouring the virus of Marseilles fever, at least during the first part of the winter, though possibly only a weakened form of it.

Papers noticed by Title only.

Mukerji (S.). **Morphology of the Pharynx of Female** *Culicoides* **and its taxonomic Importance.**—*Nature*, cxxvii, no. 3201, pp. 339–340, 1 fig., 1 ref. London, 7th March 1931.

Martini (E.). **Culicidae.**—In Lindner, *Flieg. Palaearkt. Reg.*, xi & xii, pp. 321–398, 70 figs. Stuttgart, E. Schweizerbart, 1931. [Conclusion, *cf. R.A.E.*, B, xix, 24.]

Vogel (R.). **Eine für Deutschland neue Stechmücke,** *Aëdes refiki* **Medschid.** [A Mosquito new to Germany, *A. refiki.*]—*Intern. Rev. ges. Hydrob. Hydrogr.*, xxv, no. 3–4, pp. 257–258. Leipzig, 1931.

[Gritzaĭ (P. K.).] **Грицай (П.К.). Data on the Biology of** *Anopheles maculipennis*, **Mg. and the Evaluation of anti-mosquito Measures in the Town of Kharkov and its Environs.** [*In Russian.*]—*Trop. Med. Vet.*, viii, no. 1, pp. 49–56. Moscow, January 1930. [Recd. 1931.] [*Cf. R.A.E.*, B, xix, 51.]

Brug (S. L.). *Anopheles incognitus* **n. sp.** [Described from a larva from Dutch New Guinea.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxi, no. 2, pp. 136–137, 1 fig. Batavia, 1st February 1931.

Hopkins (G. H. E.). **Larvae of Ethiopian Mosquitos** [descriptions of 10 species from Uganda with a key to the larvae of the Ethiopian genera].—*Bull. Ent. Res.*, xxii, pt. 1, pp. 89–104, 15 figs., 15 refs. London, March 1931.

Curry (D. P.). **Recognition of** *Anopheles argyritarsis* **by the Characteristics of the Male Genitalia.**—*Amer. J. Hyg.*, xiii, no. 2, p. 648, 1 ref. Baltimore, Md., March 1931. [*Cf. R.A.E.*, B, xviii, 192.]

Campos R. (F.). **Contribución al estudio de los mosquitos que habitan la ciudad y zonas adyacentes.** [A Contribution to the Study of the Mosquitos of the City of Guayaquil and its Environs.]—*Rev. Col. nac. Vicente Rocafuerte*, xii, no. 40–41, pp. 3–11. Guayaquil, 1930. [*Cf. R.A.E.*, B, xiv, 152.]

da Costa Lima (A.). **Sobre as especies dos generos** *Sabethes* **e** *Sabethoides* **(Diptera: Culicidae).**—*Mem. Inst. Oswaldo Cruz*, xxv, no. 1, pp. 51–64, 3 pls., 11 refs. Rio de Janeiro, 1931.

da Costa Lima (A.). **Nota sobre sabethineos do grupo** *Joblotia* [*Joblotia, Goeldia, Isostomyia*] **(Diptera: Culicidae).**—*Mem. Inst. Oswaldo Cruz*, xxv, no. 1, pp. 65–71, 9 pls., 8 refs. Rio de Janeiro, 1931.

DAUTERT-WILLIMZIK (E.). **Einige Beobachtungen über das Geschlechtsleben der Männchen der Schlupfwespe** *Nasonia brevicornis* **Ashm.** [Observations on the sexual Activity of Males of *Mormoniella vitripennis*, Wlk.]—*Zool. Anz.*, xciii, no. 11–12, pp. 306–308, 1 ref. Leipzig, 20th March 1931.

KRÖBER (O.). **Die** *Tabanus*-**Gruppen** *Straba* **End. und** *Poecilosoma* **Lutz.** (= *Hybostraba* **End. und** *Hybopelma* **End.) der neotropischen Region.**—*Zool. Anz.*, xciv, no. 3–4, pp. 67–89, 20 figs. Leipzig, 20th April 1931.

ENDERLEIN (G.). **Zwei neue** *Toxorhynchites* **aus dem Kongogebiete.** [Two new Species of *Megarhinus*, from the French Congo and Spanish Guinea respectively.]—*Zool. Anz.*, xciv, no. 3–4, pp. 123–125. Leipzig, 20th April 1931.

JORDAN (K.). **Three new Species of** *Neopsylla* **(Siphonaptera) from the Oriental Region.**—*Novit. Zool.*, xxxvi, no. 2, pp. 220–224, 5 figs. Tring, 22nd April 1931.

JORDAN (K.). **Siphonaptera collected by Mr. F. J. Cox in France.**—*Novit. Zool.*, xxxvi, no. 2, pp. 225–229, 4 figs. Tring, 22nd April 1931.

JORDAN (K.). **Records of Fleas from the Austrian Tirol and the Dolomites.**—*Novit. Zool.*, xxxvi, no. 2, pp. 230–232, 1 fig. Tring, 22nd April 1931.

JORDAN (K.). **On some Fleas collected by Monsieur Heim de Balzac in Western Algeria.**—*Novit. Zool.*, xxxvi, no. 2, pp. 233–234, 4 figs. Tring, 22nd April 1931.

DYER (R. E.), RUMREICH (A.) & BADGER (L. F.). **Typhus Fever. A Virus of the Typhus** [Brill's disease] **Type derived from Fleas collected from wild Rats.**—*Publ. Hlth. Reps.*, xlvi, no. 7, pp. 334–338, 7 refs. Washington, D.C., 13th February 1931. [For summary see *R.A.E.*, B, xix, 93.]

LUNDBLAD (O.). **Om några fall av hönsloppa** (*Ceratophyllus gallinae*) **på människor.** [Several Cases of the Hen-flea (*C. gallinae*, Schr.) attacking Man in Denmark and Sweden.]—*Ent. Tidskr.*, li, no. 3–4, pp. 253–255. Stockholm, 1930.

[PAVLOVSKIĬ] PAWLOWSKY (E. N.). **Sammeln, Züchtung und Untersuchung von Zecken und Flöhen.** [The Collection, Breeding and Examination of Ticks and Fleas.]—In ABDERHALDEN, *Handb. biol. Arbeitsmeth.*, Abt. ix, Teil 7, pp. 11–160, 94 figs., 8 pp. refs. Berlin, 1930.

[PAVLOVSKIĬ] PAWLOWSKY (E. N.) & STEIN (A. K.). **Experimentelle Untersuchung über die Wirkung des Bisses der Walzenspinne** *Galeodes araneoides* **auf den Menschen.** [An experimental Investigation on the Effect of the Bite of the Spider, *G. araneoides* on Man.]—*Z. Parasitenk.*, iii, no. 3, pp. 8–16, 4 figs., 27 refs. Berlin, 1930.

STANLEY (J.). **Studies on the musculatory System and Mouth Parts of** [*Echinolaelaps*] *Laelaps echidninus* **Berl.**—*Ann. Ent. Soc. Amer.*, xxiv, no. 1, pp. 1–18, 3 pls., 1 fig., 11 refs. Columbus, Ohio, March 1931.

WEED (A.). **Problems in the Manufacture of Liquid Household Insecticides of the Petroleum Extract of Pyrethrum Type.**—*J. Econ. Ent.*, xxiv, no. 1, pp. 95–97. Geneva, N.Y., February 1931. [See *R.A.E.*, A, xix, 344.]

RICHARDSON (H. H.). **An insecticidal Method for the Estimation of Kerosene Extracts of Pyrethrum.**—*J. Econ. Ent.*, xxiv, no. 1, pp. 97–105, 1 pl., 2 graphs, 12 refs. Geneva, N.Y., February 1931. [See *R.A.E.*, A, xix, 344.]

Durand (P.). *Rhipicephalus sanguineus* **et virus de la fièvre boutonneuse de Tunisie.**—*C.R. Acad. Sci. Fr.*, cxcii, no. 14, pp. 857–859, 2 refs. Paris, 1931.

Repeating experiments with *Rhipicephalus sanguineus*, Latr., in Tunis that had been already carried out in the south of France [*R.A.E.*, B, xix, 38], the author found that here also the tick harboured the virus of Marseilles fever in nature and could preserve it for several weeks without contact with man, crushed adults inoculated into man and monkeys inducing the disease.

Delanoë (P.). **Le mérion, réservoir de virus du Spirochète marocain,** *Sp. hispanicum* **var.** *marocanum* **Nicolle et Anderson, 1928.**—*C.R. Acad. Sci. Fr.*, cxcii, no. 14, pp. 859–860. Paris, 1931.

The author records the finding of *Spirochaeta hispanica* var. *marocana* in a gerbille, *Meriones shawi*, taken in a locality in Morocco, where porcupine and fox burrows containing infective examples of *Ornithodorus* [*erraticus*, Lucas] are numerous.

Cooley (R. A.). **Review of Tick Parasite Work for 1929 and 1930.**—*8th Bienn. Rep. Montana St. Bd. Ent. 1929–30*, pp. 16–25, 1 map, 1 ref. [Helena, Mta., 1931.]

The rearing of *Ixodiphagus caucurtei*, du Buysson, for the control of *Dermacentor venustus*, Banks (*andersoni*, Stiles) in Montana has been continued, using methods already described [*R.A.E.*, B, xvii, 124], but the numbers bred have been greatly increased. The adult ticks are fed on rabbits, and the fully engorged females are recovered and stored in thermal cabinets at a temperature of 38–45° C. [100·4–113° F.]. It has been found possible to maintain living stocks of both ticks and parasites in all stages in thermal cabinets.

As it is important to know whether parasites liberated have attacked *D. venustus* in nature, living squirrels and chipmunks were captured in 1929 in an area where parasites had been liberated. They were kept in cages until the attached ticks had completed their feeding. In some of the ticks parasites developed, showing that they had survived the winter. In 1930 a similar procedure was followed, but no parasites were recovered. This suggests either that the parasites had been killed during the winter, or that they are not attacking *D. venustus* under natural conditions. On the other hand they were recovered after the previous winter, and in overwintering experiments some of the parasites have been found to survive the winter in eastern, central and western Montana. Moreover, it is possible that failure to recover them was due merely to the fact that they had dispersed very rapidly. The speed with which an introduced parasite can multiply to numbers sufficient to overcome its host, or to be detected, depends on many factors, some of which are tentatively discussed. It seems probable that there is one generation of *I. caucurtei* a year in Montana, although, in exceptional seasons, there may be two.

Work on the parasitism of larvae and nymphs of *D. venustus* [xvi, 162] has been continued. Adult parasites were released on rabbits infested with larvae and nymphs on 6th February 1930. After 24 hours, 7,000 fed larvae and 980 fed nymphs were recovered. The nymphs were kept at a temperature of 22° C. [71·6° F.], and on 11th March it was estimated that 80·9 per cent. were parasitised. The larvae were

kept for two months at the same temperature and then placed out-of-doors. On 13th June, the resulting nymphs were placed on a rabbit, and 212 engorged nymphs were recovered. These were kept at 71·6° F. to allow the parasites to mature. On 24th July, 59·4 per cent. of the nymphs were found to be parasitised. It is possible that the length of time during which the nymphs were kept unfed may have reduced the percentage of ticks in which the parasites matured, but this condition was introduced into the experiment because nymphs usually pass the winter before obtaining their next feed. These results indicate that in the presence of larvae and nymphs, the parasite will lay eggs in both. It has been found in laboratory experiments that *I. caucurtei* will also attack *Haemaphysalis leporis-palustris*, Pack. (rabbit tick), which is fairly common in Montana and in most other States. As the habits of this tick are different from those of *D. venustus*, it is believed that this will give the parasite an added opportunity for oviposition.

KOHLS (G. M.). **A Summary of Parasite Liberations.**—*8th Bienn. Rep. Montana St. Bd. Ent. 1929–30*, pp. 26–34, 1 map. [Helena, Mta., 1931.]

The methods used for the liberation of *Ixodiphagus caucurtei*, du Buysson, against *Dermacentor venustus*, Banks (*andersoni*, Stiles) in Montana are briefly outlined [*cf. R.A.E.*, B, xvii, 122]. In regions where, owing to the hot dry weather, parasites might fail to emerge on account of the desiccation of the nymphal shell of the host tick, engorged nymphs are placed in a glass tube drawn out at one end to a bore of about 1 mm. and plugged at the other end with cotton wool. The plugged end of the tube is inserted into the cork stopper of a vial filled with water. As the water evaporates and passes out through the tube, the parasitised nymphs are subjected to a certain degree of humidity. The parasites escape through the small opening in the upper end of the tube. Nymphs containing parasites in the egg, larval or pupal stages are sometimes broadcast in the haunts of rodents, where emerging parasites will have opportunities of finding ticks.

Details are given of the numbers of parasites liberated in various localities throughout the State during 1928, 1929 and 1930, the total amounting to nearly two millions.

During 1929, confined, parasitised nymphs were placed in several of the liberation areas and examined at regular intervals throughout the summer in order to determine the progress of development and the approximate date of emergence of the parasites in liberated material. The number of days required for the parasites to reach maturity varied from 91 for those in nymphs liberated on 14th May to 55 for those in nymphs released on 2nd July. Thus owing to more rapid development at summer temperatures, parasites liberated in the egg stage in active engorged nymphs during May, June and July tend to attain maturity and emerge at about the same date, namely from the middle to the end of August.

[GALUZO (I. G.).] **Галузо (И. Г.). On the Rôle of Ticks in the Economics of Agriculture and their Control.** [*In Russian.*]—*Za Rekonstr. sel'sk. Khoz.* [*For the Reconstr. Agric.*], i, no. 7, pp. 99–108. Samarkand, October 1929. [Recd. 1931.]

In connection with plans for improving the condition of cattle in Uzbekistan, special attention has been paid in Russia to the study of

tropical diseases of domestic animals and the mode of their transmission. In Central Asia cattle suffer especially heavily from ticks, and a general review is given from the literature of the effect of infestation on domestic animals, together with a list of the diseases of these animals that ticks transmit in various parts of the world.

Bishopp (F. C.) & Wagner (R. D.). **Nicotine in the Control of Ectoparasites of Poultry.**—*J. Econ. Ent.*, xxiv, no. 1, pp. 56–62, 4 refs. Geneva, N.Y., February 1931.

The results obtained with nicotine sulphate in the contol of *Liponyssus sylviarum*, C. & F., and *Dermanyssus gallinae*, DeG., attacking fowls are summarised, and details are given of a series of tests. Experiments with *L. sylviarum* indicate that a single treatment of the roosts with nicotine sulphate cannot be relied on to control an infestation [*cf.* *R.A.E.*, B, xvii, 163, etc.], the number necessary for eradication depending on the extent of the infestation and whether supplemental control measures, such as removing litter and spraying or dusting the fowl house and nests, are carried out at the same time. Nicotine sulphate was found to be very effective against *D. gallinae* when applied pure or diluted with water. Most of the practical tests with mites, which were carried out in July when the temperature was high, were made by thoroughly spraying infested fowl houses with 1 part nicotine sulphate in 9 parts water and then closing them for about 8 hours. On the day following the application the mites were greatly reduced in numbers, and by the end of the third day no live mites could be found and there was no recurrence of infestation. Nicotine sulphate diluted 1 : 50 with 1 oz. soap per U.S. gallon added also gave satisfactory control.

Spraying the fowl houses with nicotine sulphate, 1 : 9, was also found to be effective against *Argas persicus*, Oken (*miniatus*, Koch), but the treatment is more expensive and less lasting than if anthracene oil is used. Experiments against *Echidnophaga gallinacea*, Westw., showed that the application of nicotine sulphate to the perches did not destroy the adult fleas attached to the heads of the fowls, but spraying the floors of infested poultry houses with a dilution of 1 : 4–9 destroyed all the adults present.

In tests against the lice, *Eomenacanthus stramineus*, Nitz., *Menopon gallinae*, L., *Goniocotes gallinae*, Retz. (*hologaster*, Nitz.), *Lipeurus caponis*, L., and *L. heterographus*, Nitz., a large percentage was killed during the first night following an application of nicotine sulphate to the upper surface of the perches half an hour before the fowls went to roost. Some were killed on the second night and a few on the third, but the eggs were not all killed and the precise effect on them was not determined. Although some of the lice that dropped off the fowls were found alive, they were noticeably affected by the treatment and subsequently died. *E. stramineus* was the least effectively controlled by the treatment, and *L. caponis* was less susceptible than the three other species.

The results of tests to determine the interval between applications likely to be most effective, although not conclusive, showed a 9-day interval to be most satisfactory, no hatching being observed after the second treatment. The even distribution of the material over the

entire upper surface of 2-inch perches seemed to be as effective as any. Results secured with free nicotine were practically identical with those obtained with nicotine sulphate, but the greater volatility of the former necessitated more ventilation. The fowls do not suffer in any way provided that reasonable care is used in making the applications. Caution must be observed where nicotine sulphate is applied to freshly whitewashed poultry houses, since lime in combination with nicotine sulphate releases free nicotine.

The use of nicotine sulphate has advantages over the individual treatment of the birds with sodium fluoride in that it is more quickly applied and costs less owing to the smaller amount of labour involved.

MELVIN (R.) & BECK (D. E.). **Length of the developmental Stages of the Horn-fly, *Haematobia irritans* (Linné), at constant Temperature.**—*J. Econ. Ent.*, xxiv, no. 1, pp. 330–331. Geneva, N.Y., February 1931.

Data obtained from observations made during the summer of 1930, the technique of which is described, indicate that at 25° C. [77° F.] the incubation period of *Lyperosia* (*Haematobia*) *irritans*, L., averages 19 hours 35 minutes and at 30° C. [86° F.] 14 hours 25 minutes. At 30° C. the egg, larval and pupal period average 238 hours 35 minutes.

LITTLE (V. A.). **Devil's Shoe-string as an Insecticide.**—*Science*, lxxiii, no. 1890, pp. 315–316, 1 ref. New York, N.Y., 20th March 1931.

Following experiments in Texas that showed the toxicity of aqueous suspensions of finely ground dried roots of *Tephrosia* (*Cracca*) *virginiana* (devil's shoe-string) as a contact spray [*R.A.E.*, A, xix, 319] against a variety of insects, this material was tested against parasites of animals. Almost perfect control of various species of fleas and lice was obtained, as well as encouraging results against the larvae of *Hypoderma lineatum*, Vill., in cattle.

FROBISHER, jr. (M.) & SHANNON (R. C.). **The Effects of certain Poisons upon Mosquito Larvae.**—*Amer. J. Hyg.*, xiii, no. 2, pp. 614–622, 4 refs. Baltimore, Md., March 1931.

In laboratory tests with a number of substances, carried out at Bahia, Brazil, with a view to discovering one that would destroy mosquito larvae in certain outdoor water-containers and also eventually disappear from the water, 10 cc. of solutions of the various substances were placed in test tubes and 5–10 larvae contained in a drop or two of water were transferred to each. The time required for a given solution to kill was recorded when the last larva had ceased to show the slightest observable motion. Iodine, to which the newly hatched larvae were by far the most susceptible, was found to be fatal to full-grown larvae of *Aëdes argenteus*, Poir. (*aegypti*, auct.), *A. taeniorhynchus*, Wied., and *Culex fatigans*, Wied. (*quinquefasciatus*, Say) in concentrations of about 1 per million. The pupae, which were much more resistant to iodine than the larvae, are probably protected by their thickly

sclerotised cuticle and lack of gills. Bromine was found to be almost as poisonous to the larvae as iodine. It is suggested that iodine, and possibly the halogens as a group, poison the larvae by chemical combination with the body lipoids, especially those of the nervous system, possibly by saturation of multiple bonds of the fatty acid radicles.

Potassium cyanide was found to be relatively inert as compared with iodine. Even in a solution as strong as 1 per cent., the full-grown larvae of *A. argenteus* were able to survive for nearly an hour, and they lived for about 10 minutes in a 10 per cent. solution. The action of this substance in the higher (10 per cent.) concentrations is believed to have been due in some part to the alkalinity of the solutions, since potassium hydroxide was found to be almost as effective in these circumstances. Hydrocyanic acid gas killed within 10 minutes when applied in an air chamber to larvae in a thin film of water. The gas probably gains entrance to the body more rapidly in adults, which are killed almost instantly. Calcium hypochlorite was found to kill mature larvae of *A. argenteus* in 34 minutes in a concentration of approximately 5 per cent. It seems probable that chlorine was the most active agent and that it has a larvicidal potency comparable with that of iodine and bromine [*cf. R.A.E.*, B, v, 47], and it further appears not unlikely that fluorine might exert a poisonous action comparable with that of the other members of the halogen group.

Iodine may be applied to drinking water in concentrations sufficient to kill larvae, yet insufficient to give a perceptible taste. Its general use as a larvicide in drinking water, however, is not recommended at present, owing to the difficulty of applying the exact concentration desired and of maintaining a uniform concentration over long periods, and also in view of possible undesirable effects on man. Its use in cisterns, tanks and barrels, and in places where the water is not to be employed for drinking purposes, and where a more or less transitory action is desired, may be advantageous, and its experimental use under field conditions is suggested.

CURRY (D. P.). *Anopheles (Anopheles) neomaculipalpus.* **A new Species of the** *Arribalzagia* **Group of** *Anopheles* **from Panama.**—*Amer. J. Hyg.*, xiii, no. 2, pp. 643–647, 1 fig., 3 refs. Baltimore, Md., March 1931.

Of the *Arribalzagia* group of *Anopheles*, only two species, *A. apicimacula*, D. & K., and *A. punctimacula*, D. & K., have been known until recently from the vicinity of the Panama Canal. A third species, *A. vestitipennis*, D. & K., has been taken in the western part of the Republic of Panama. Larvae of *A. apicimacula* and *A. punctimacula* are found chiefly in well-shaded pools, frequently in association with other shade-loving species, such as *A. eiseni*, Coq., *A. bathanus*, Dyar, *A. nimbus*, Theo., and a recently discovered member of the *Nyssorhynchus* group, which may prove to be *A. tarsimaculatus* var. *oswaldoi*, Peryassú.

The larvae of *A. neomaculipalpus*, sp. n., both sexes of the adult, and the larva and pupa of which are described, have been taken in considerable numbers from water in cattle tracks exposed to the sun in low-lying marshy pastures on the Atlantic side of the Isthmus near Gatun and on the Pacific side in the flat coastal savannahs east of Panama City. Keys are given to the adults (one based on male genitalia), pupae and larvae of *A. neomaculipalpus*, *A. apicimacula* and *A. punctimacula*.

Missiroli (A.). **La prevenzione della malaria nel campo pratico. Terza relazione (1928-1929).** [The Prevention of Malaria in Practice. Third Report (1928–1929).]—*Riv. Malariol.*, ix, pt. 6, pp. 667–705, 11 tables, 8 pls. Rome, 1930. (With Summaries in Italian, p. 806, French, p. 808, English, p. 810, German, p. 812.)

This third and last of a series of reports [*R.A.E.*, B, xv, 230; xvii, 2] on five years' work on the prevention of malaria by measures against Anopheline larvae includes an account of the use of Paris green against *Anopheles maculipennis*, Mg., in Sicily, Sardinia and Italy. The results confirm the conclusion that drainage and consequent intensive cultivation, with an increase in the numbers of cattle, which gradually come to attract Anophelines away from man [*cf.* xix, 68], are the only radical measures, and that to render them possible, mosquito larvae should be controlled with Paris green. A liberal use of quinine reduces the severity of the disease, but cannot affect its incidence. A study of impounded waters indicates that after 5–6 years a biological balance is reached that is unfavourable to Anopheline development, and that this is the reason why artificial lakes that produce Anophelines in abundance when first formed cease to do so after 5–6 years when their fauna approximates to that of natural lakes. As regards larvicidal fish, the introduced *Gambusia* is less affected by natural enemies than are indigenous ones. *Gambusia* is very prolific and is viviparous, and for these reasons displaced *Cyprinodon calaritanus* at Ostia in 3–4 years.

Hecht (O.). **Ueber den Wärmesinn der Stechmücken bei der Eiablage.** [On the Thermotropism of ovipositing Mosquitos.]—*Riv. Malariol.*, ix, pt. 6, pp. 706–724, 3 figs., 13 refs. Rome, 1930. (With Summaries in Italian, p. 806, French, p. 808, English, p. 810, German, p. 812.)

In experiments in which mosquitos ready to oviposit were given the choice of water at different temperatures in which to lay their eggs, *Anopheles maculipennis*, Mg., never oviposited in water above 32–34° C. [89·6–93·2° F.], and only exceptionally below 15° C. [59° F.], the preferred range being 22–29° C. [71·6–84·2° F.]. *A. bifurcatus*, L., preferred cooler water, most of the eggs being laid at 12–20° C. [53·6–68° F.], and none at 25° C. [77° F.]. In the case of *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.), most of the eggs were laid between 20 and 30° C. [68 and 86° F.], but the temperature limits were less sharply defined than with the Anophelines. It is not known whether radiation from the dishes or the actual temperature was the determining factor.

Jancsó (N.) & D'Engel (R.). **Observations sur les réviviscences du paludisme aux environs de la ville de Kolozsvar, pendant une période de cinquante ans.**—*Riv. Malariol.*, ix, pt. 6, pp. 725–733. Rome, 1930. (With Summaries in Italian, p. 806, French, p. 808, English, p. 810, German, p. 812.)

During clinical observations extending from 1873 to 1919 at Kolozsvar, Transylvania, three epidemics of malaria, which occurred in 1870–82, 1890–1904 and 1916–20, have been studied. Experiments bearing on the infection of man and mosquitos have been made [*cf. R.A.E.*, B, x, 90], but no factor that would explain the appearance and disappearance of the epidemics has been found.

Ciacchi (O.). **Appunti sulla tecnica dell' inoculazione della malaria per mezzo di anofeli infetti.** [Notes on the Technique of the Inoculation of Malaria by Means of infected *Anopheles*.]—*Riv. Malariol.*, ix, pt. 6, pp. 777–784, 4 figs. Rome, 1930. (With Summaries in Italian, p. 807, French, p. 809, English, p. 811, German, p. 813.)

A gauze cage with a wire framework (8 by 4 by 4 ins.) is described that is designed for applying Anophelines to malaria patients and then to the case to be infected. The cage is placed on the thigh or abdomen and covered so as to be warm and dark.

van Thiel (P. H.). **Züchtungsversuche in Zusammenhang mit dem Rassenproblem bei** *Anopheles maculipennis*. [Breeding Experiments in Connection with the Problem of Races in *A. maculipennis*.] —*Arch. Schiffs- u. Tropenhyg.*, xxxv, no. 4, pp. 208–227, 22 refs. Leipzig, April 1931.

An account is given of a detailed study that has confirmed the results of Achundow's experiments on the production, by different coloured containers for the larvae, of differences in the colour and size of *Anopheles maculipennis*, Mg. [*R.A.E.*, B, xvii, 32, 171], though the size of the adults was only affected if a single larva was placed in each container. Under natural conditions, however, only the existence of genetic differences can explain satisfactorily the contrast between the typical *A. maculipennis* and *A. maculipennis* var. *atroparvus*, van Thiel [*cf.* xviii, 211]. The " normal development curve " of the larvae was studied. Where many larvae were present in a container, the rate of development was retarded, provided that there was no heavy larval mortality. Development was slightly more rapid in white containers than in those of other colours. If the water-surface was less than 4 sq. cm. per larva in a container with several larvae, both the number and size of the resulting adults were reduced.

[Apriamov (G. G.).] **Априамов (Г. Г.). Zur Biologie der** *Anopheles maculipennis* **Meig. und** *A. bifurcatus* **L. im Rayon der Stadt Wladikawkas.** [*In Russian.*]—*Trav. Sta. biol. Caucase du Nord*, iii, fasc. 1–3, pp. 145–154, 12 refs. Vladikavkaz, 1930.

A survey of Anopheline larvae in 1929 in and near the town of Vladikavkaz, North Caucasus, showed that *Anopheles maculipennis*, Mg., had four or five generations and was far more abundant than *A. bifurcatus*, L., especially in the autumn, whereas in 1928, which was colder and wetter, *A. bifurcatus* was the more numerous. The breeding-places available consist of permanent streams, and pools, ditches and small swamps covered with vegetation. The character of these is described, and the relative numbers of the two species occurring in the swamps at different dates are discussed. The chief breeding-place of *A. bifurcatus*, however, was a forest stream with a slow current. Small pools of rain-water and ditches along roads harboured *A. maculipennis* only.

[Bruck (R.).] **Брук (Р.). Zur Frage über die Ernährung der Larven von** *Anopheles maculipennis.* [On the Question of the Nourishment of the Larvae of *A. maculipennis.* (*In Russian.*)]—*Trav. Soc. Nat. Leningrad*, lx, no. 1, pp. 15–28, 9 refs. Leningrad, 1930. (With a Summary in German.)

The results of observations, which are described in detail, on the feeding of fourth instar larvae of *Anopheles maculipennis*, Mg., show that, on an average, 40–60 minutes elapse from the moment the food is swallowed until it is excreted. The rate at which the food particles pass through the digestive tract depends on the rate at which they are taken, and is not affected by their nature or relative size.

Leeson (H. S.). **Anopheline Mosquitos in Southern Rhodesia 1926-1928.**—*Mem. Lond. Sch. Hyg. Trop. Med.*, no. 4, ix+55 pp., 15 pls., 10 figs., 44 refs. London, March 1931. Price 8*s*.

An account is given of observations on the Anophelines of Southern Rhodesia made between 1st September 1926 and 31st December 1928, much of the information having already been noticed [*R.A.E.*, B, xvi, 104 ; xix, 68]. The list of species collected includes all those previously mentioned [xvi, 104] with the exception of *Anopheles christyi*, N. & C., and the addition of *A. transvaalensis*, Cart., *A. longipalpis*, Theo., and *A. nili*, Theo. Anophelines are most prevalent during the rainy season from October to April, the maximum numbers being reached in March, when the predominant species are *A. funestus*, Giles, *A. gambiae*, Giles, and *A. pretoriensis*, Theo. *A. squamosus*, Theo., and *A. rufipes*, Gough, were more common at the commencement of the rains. These five species comprised 97 per cent. of the adult Anophelines taken.

Particular attention was paid to the localities of Shamva and Salisbury, which were under continuous observation from the beginning of the inquiry, as they presented entirely opposite aspects of the mosquito problem, Shamva being in an area where blackwater fever occurs and Salisbury in a region that is free from it. Salisbury is a well-developed progressive municipality situated at an altitude of not less than 4,900 ft., whereas Shamva is a not very prosperous rural town, 56 miles north-east of Salisbury, situated at an altitude of 3,600 ft. Four of the five predominant mosquitos were present at Shamva, *A. squamosus* being very rare ; in Salisbury *A. pretoriensis*, *A. rufipes* and *A. squamosus* were common, and *A. gambiae* and *A. funestus* were very rare. The actual numbers were greater in Shamva than in Salisbury, the ratio of the captures being approximately 10 : 1. The seasonal prevalence, distribution and breeding-places of the four species common in Shamva are discussed in some detail, with brief notes on the other species, which include *A. funestus* var. *fuscivenosus*, Leeson [xviii, 247]. It was observed that when the number of cases of malaria was lowest, *A. funestus* was hibernating and *A. gambiae* was entirely absent. The importance of environment in control is demonstrated by the fact that in Salisbury during the course of development of sanitation along modern lines, an environment is being produced that is unsuitable for Anophelines, particularly *A. funestus* and *A. gambiae*.

General methods of mosquito control are not discussed, but suggestions as to additional measures that might be used in Southern Rhodesia are given. In places, such as Shamva, where a stream flows through the village, it might be possible to build a dam upstream that could be

opened at certain times to flush out the breeding-places along the river bed in the village area. The drifts or fords are gradually being replaced by low-level bridges that do not offer so much resistance to the current as the drifts. Where the abolition of ponds is impossible or undesirable, dusting with Paris green was found to be effective. The carrier, which consisted of the fine, white, pulverised rock that is left in dumps near gold mines, was used in the proportion of 99 : 1. The largest numbers of adults were collected out-of-doors, among grass, low scrub, etc., and such vegetation should be removed from the vicinity of houses. As Anophelines were always more numerous in the poorer type of house, regulations to abolish houses not conforming to a certain standard are urgently needed in settled communities. Rain-water tanks should be mosquito-proof and the end of the overflow pipe should be covered with gauze. In an appendix, keys are given for the identification of the males, females and fourth-stage larvae of the Anophelines of Southern Rhodesia with short descriptions of the commoner species; certain points, in which the morphology of the larvae of *A. marshalli*, Theo., *A. rufipes* and *A. cinereus*, Theo., differ from previous descriptions, are also recorded. In a second appendix a list is given of the Culicines collected in Southern Rhodesia.

BARROWMAN (B.). **Anti-malarial Oils and their Specification.**—*Malayan Med. J.*, vi, no. 1, pp. 7–11, 7 charts. Singapore, March 1931.

On five estates in Malaya where a stock mixture said to be composed of 4 parts kerosene, 45 parts Solar oil and 15 parts crude oil was used for the control of Anopheline larvae, the hospital admission rate for malaria in the first half of 1928 was 6 per cent. of the population per month. On six adjoining estates that prepared their own mixture, the figure was 0·6 per cent. Moreover, on an estate using its own mixture, the admission rate from January 1927 to April 1928 was 0·3 per cent. This rate rose to 3·5 per cent. in June after a stock mixture had been used for a month, and *Anopheles maculatus*, Theo., was found living in the oiled water. On reversion to the original mixture, the rate dropped, and from July 1928 to September 1930 has averaged 0·2 per cent. per month. Small scale laboratory experiments were therefore undertaken to determine the toxicity of these oils alone and in various combinations. It was found that crude oil alone was comparatively non-toxic in the quantity used. Kerosene alone was rapidly toxic to young larvae, but the older larvae, although quickly rendered comatose, were able to recover after the toxic effect of the kerosene was lessened by evaporation and breaking of the film. Solar oil was the most toxic of the three oils alone, but mixtures of kerosene, Solar and crude oil in the proportions of 1 : 1 : 1, 1 : 5 : 10 or 2 : 25 : 5 were equally or more effective. Mixtures of kerosene in crude oil were less effective and gave a less satisfactory film. Observations on the spreading and lasting properties of the various films showed that mixtures in the proportions of 1 : 2 : 13 and 1 : 5 : 10 covered the surface and did not break up into either streaks or globules. Experiments on a larger scale were carried out with these and similar mixtures. The 1 : 5 : 10 mixture gave the most lasting film and as it was more generally effective than any of the stock mixtures on the market, though it did not actually give the highest experimental mortality of the larvae, it has been recommended since 1928. Oil companies prepare their mixtures to satisfy a specification of in-

flammability that does not appear to have any relation to their suitability for mosquito control. The specification for an oil to be used for mosquito destruction has never been determined, but it is suggested that the volatility should be within a certain range (as volatility and toxicity appear to be closely related) and that the range for surface tension should also be defined. It is also important in the field that the oil should not be too thin, or too small a quantity will leave the nozzle if the distributor is walking at a reasonable pace, and the efficiency is consequently reduced unless he walks very slowly or retraces his steps ; in either case time is wasted.

The mixtures most successful in controlling malaria, of which 1 : 5 : 10 was the best, are not those giving the highest mortality among larvae in the laboratory, and it is the author's opinion that the main function of an anti-mosquito oil is to render the water repellent to ovipositing females, which are forced to leave the district or die without laying their eggs.

Brug (S. L.). **Filariasis in Nederlandsch-Indië, III.**—*Geneesk. Tijdschr. Ned.-Ind.*, lxxi, no. 3, pp. 210–240, 2 maps, 30 refs. Batavia, 1st March 1931. (With a Summary in English.)

This paper discusses the replies of about a hundred medical men throughout the Netherlands Indies to a questionnaire on the epidemiology of filariasis. Both *Filaria* (*Microfilaria*) *malayi* and *F.* (*M.*) *bancrofti* occur in man in Sumatra, Java, Borneo, and Celebes, and *F. bancrofti* only in New Guinea. *F. malayi* predominates generally, except in Java, where filariasis is relatively rare.

Snijders (E. P.). **Over de overbrenging van de endemische Sumatraansche dengue.** [On the Transmission of endemic Sumatran Dengue.] —*Geneesk. Tijdschr. Ned.-Ind.*, lxxi, no. 3, pp. 241–249, 3 figs. Batavia, 1st March 1931.

To obtain definite evidence of the transmission of the dengue-like fevers of the Netherlands Indies by mosquitos of the genus *Aëdes*, females of *A. argenteus*, Poir. (*aegypti*, auct.) and *A. albopictus*, Skuse, bred from larvae collected in Sumatra, were fed on infected persons and then sent to Holland where neither they nor the disease occurs. Typical dengue was there produced in persons on whom they fed. It is not certain whether the endemic dengue of Sumatra is true dengue or van der Scheer's fever [see next paper] and whether these are distinct diseases.

Mertens (W. K.). **Experimenteele van der Scheer's koorts (Voorloopige mededeeling).** [Van der Scheer's Fever produced experimentally. Preliminary Communication.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxi, no. 3, pp. 250–259. Batavia, 1st March 1931.

The fever described in 1894 by van der Scheer resembles yellow fever as well as dengue, and is considered by the author to be distinct from the latter. It is widely distributed in the Malay Archipelago and occurs chiefly in low-lying areas, such as the sea-coast, where high temperature and moisture are combined, an ideal condition for mosquitos. A number of infection experiments were made with over sixty volunteers, and some of these were successfully infected by laboratory-bred females

of *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) and *A. albopictus*, Skuse. In the case of *A. argenteus*, the mosquitos first became infective 9 days after the infecting feed and one remained so for 65 days. A single mosquito was able to produce infection, and infectivity was retained after repeated feeds. With *A. albopictus* it was not possible to ascertain the time that elapses before the mosquito becomes infective because, owing to its high mortality and unwillingness to feed, mosquitos of various batches were used together. Several were required to produce infection. It is thought that during the period of incubation in the mosquito the virus merely increases in quantity [*cf.* next paper], for though injections of the filtrate of 15 females of *A. argenteus* failed to produce infection 5 days after feeding, a positive result was achieved with the filtrate of 50. The virus in infected mosquitos was not passed on to their progeny.

Holt (R. L.) & Kintner (J. H.). **Location of Dengue Virus in the Body of Mosquitoes.**—*Amer. J. Trop. Med.*, xi, no. 2, pp. 103–111, 6 figs. Baltimore, Md., March 1931.

In an endeavour to locate the portions of the body of *Aëdes argenteus*, Poir. (*aegypti*, auct.) that harbour the virus of dengue fever, experiments were carried out in the Philippines in which five volunteers were inoculated with serum containing respectively the macerated legs, salivary glands, stomachs, intestines and ovaries of 7–10 mosquitos fed on a case of dengue 20 days previously.

The following is taken from the authors' conclusions: These experiments indicate that dengue infection in *Aëdes argenteus* does not involve any particular part of the body, but is septicaemic in character. It is believed that the period of 11–14 days before the mosquito becomes infective to man, which was thought to be necessary for the "maturation of the virus," is merely the time required for it to become of such concentration in the insect as to allow of an infective dose into man. This, together with the fact that the virus may be transferred from infected to normal mosquitos [*cf. R.A.E.*, B, xix, 111] for at least three serial transfers, in a form undiminished in its ability to infect man, by feeding the normal ones on a suspension of infected mosquitos ground up in normal blood, is strong evidence against the theory that a cyclic phase of the virus takes place in the mosquito [*cf.* preceding paper].

Russell (P. F.). **Anopheles Mosquitoes and Avian Malaria.**—*Amer. J. Trop. Med.*, xi, no. 2, pp. 145–146, 1 ref. Baltimore, Md., March 1931.

In view of the fact that parasites of avian malaria have been found in *Anopheles subpictus*, Grassi [*R.A.E.*, B, xvii, 32], the author reports that although *Culex fatigans*, Wied., and *Aëdes argenteus*, Poir. (*aegypti*, auct.) fed readily on canaries kept in wire cages in screened boxes, Anophelines of various species, including *A. subpictus* (fresh water form), kept under similar conditions during a period of four months in Manila, were not observed to feed. They preferred to starve rather than to feed directly on the blood of the birds, although they fed on canary blood in saline suspension baited with mango juice. No oöcysts were seen in dissections of 40 individuals of *A. ludlowi*, Theo. (salt-water form) fed on blood from a canary harbouring numerous gametocytes of *Plasmodium cathemerium*.

Bath (C. H.). **The Practical and Research Value of Mosquito Traps.**—*Amer. J. Trop. Med.*, xi, no. 2, pp. 147–150. Baltimore, Md., March 1931.

The author describes a detachable mosquito trap for use on the screens of dwellings, the inmates of which serve as the bait. It consists essentially of a V-shaped ridge of screening with a slit in the top, inside which is a similar ridge with a smaller slit (to prevent the exit of the trapped mosquitos), the whole being surrounded by screening to prevent the mosquitos from entering the house. Near Panama City 49,496 Anophelines were caught in 32 days in 11 traps, the largest catch in one trap in one night being 4,973. These traps may be used in work for estimating mosquito density, etc., and are also believed to be of practical value in control, since the Anophelines captured are nearly all females in search of a blood-meal with which to develop their eggs.

Kligler (I. J.) & Aschner (M.). **Demonstration of Presence of Fowl Pox Virus in wild caught Mosquitoes** (*Culex pipiens*).—*Proc. Soc. Exp. Biol. Med.*, xxviii, no. 4, pp. 463–465, 2 refs. New York, N.Y., January 1931.

It has been shown that fowl-pox can be transmitted experimentally by *Culex pipiens*, L., and *Aëdes argenteus*, Poir. (*aegypti*, auct.) [*R.A.E.*, B, xvii, 241]. Continuing observations on the former, the authors obtained evidence that this mosquito taken from the vicinity of fowls infected with the disease harboured the virus, as shown by feeding and inoculation tests. No spontaneous infection occurred among healthy fowls confined in a room with infected ones unless the mosquitos were present, when healthy fowls in neighbouring cages acquired the disease.

Twinn (C. R.). **Observations on some Aquatic Animal and Plant Enemies of Mosquitoes.**—*Canad. Ent.*, lxiii, no. 3, pp. 51–61, 8 refs. Orillia, Ont., March 1931.

This paper consists of notes, made during the course of studies of mosquitos carried out chiefly in the vicinity of Ottawa, on various species of aquatic animal and plant life that have, or are reported to have, a deleterious effect on mosquito larvae. The larvae of various Chaoborines, which are predacious, occur commonly in temporary waters infested with Culicine larvae. *Corethra cinctipes*, Coq., is the most common and abundant species in the vicinity of Ottawa, although *C. culiciformis*, DeG., *Chaoborus crystallina*, DeG., and *C. punctipennis*, Say, have also been found. *Eucorethra underwoodi*, Underwood, has not been observed in the Ottawa district, but occurs in the Maritime Provinces. Various other aquatic insects are recorded as preying on mosquito larvae, the most important of which appear to be the larvae of Dytiscids.

Although the newt, *Diemictylus viridescens* [*cf. R.A.E.*, B, xvii, 242] is said to occur in southern Ontario, southern Quebec and the Maritime Provinces, it has not been found near Ottawa, but larvae of the yellow-lined salamander, *Eurycea bislineata*, taken from the type of pool in which larvae of *Aëdes* commonly develop, were kept for nearly two months on a diet consisting of the larvae of *Aëdes* and *Culex*. The disappearance of larvae of *Culex* from a bucket was found to be due to the presence of *Hydra vulgaris*, which paralyses with its tentacles many more of the larvae than it requires for food.

Larvae of *Culex* and of *Anopheles walkeri*, Theo., were observed developing normally in a small area of a lake where *Chara fragilis*, *Elodea canadensis*, bladderworts (*Utricularia*) and duckweeds (*Lemna* and *Spirodela*) were growing in abundance [*cf.* xvi, 141; xvii, 214; xviii, 68]. To check this observation, cages containing larvae of *Culex* were placed among a luxuriant growth of *C. fragilis* and *E. canadensis* at a spot where no mosquito larvae could be found. Nearly half reached the adult stage, and it therefore appears that, under certain conditions at least, these plants cannot be relied on to give satisfactory control of mosquito larvae. Larvae of *Anopheles maculipennis*, Mg., *A. punctipennis*, Say, *A. walkeri* and *Culex* occurred in several bodies of water where bladderworts were growing. *Utricularia macrorhiza* appears to be the most important as an actual or potential factor in mosquito control, though *U. intermedia* also readily traps both larvae and pupae. Owing to the small size of its bladder-traps, *U. minor* is able to capture only small, immature larvae. Although the duckweeds, *Lemna minor*, *L. trisulca* and *Spirodela*, as well as *Wolffia* sp., are common in the Ottawa district, in the author's experience they are seldom sufficiently abundant to form a mat complete enough to prevent mosquitos from breeding [*cf.* xviii, 212], particularly in temporary bodies of water where effective control is most desired. Their value in Canada is therefore considered to be negligible.

WU (Yi Fang). **A Contribution to the Biology of** *Simulium* (**Diptera**).—*Pap. Mich. Acad. Sci.*, xiii, pp. 543–599, 41 refs. Ann Arbor, Mich., 1931.

In the first part of this paper an account is given of observations in Michigan on the general biology and life-history of Simuliids, chiefly *Simulium venustum*, Say, and *S. vittatum*, Zett., with short notes on *S. jenningsi*, Mall., and *S. hirtipes*, Fries. The duration of the egg, larval and pupal periods is discussed. The habits of each stage are described, and details are given of hatching, pupation, emergence, oviposition, etc. The larvae of *S. hirtipes* were parasitised by a Nematode (probably *Mermis*), those of *S. vittatum* were occasionally infested with a protozoan parasite, and those of *S. jenningsi* were found to be attacked by a larva of *Chironomus*. A Chironomid larva also attacked the pupae.

In the second part of the paper details are given of an experimental study of a normal running water habitat, and evidence was obtained that a high dissolved oxygen content in the water is not the factor determining the restriction of Simuliid larvae to swiftly running streams, as has frequently been assumed. Not only was the surface water in the comparatively slower and quieter portions of a stream found to have practically the same amount of dissolved oxygen as the swifter and more agitated parts, but larvae survived an exposure of $12\frac{1}{2}$ hours to a low oxygen content of 13 per cent. saturation. On the other hand, larvae were never found to establish themselves in currents with a rate of flow less than 0·58 ft. per second. The food factor proved to be of less importance than current.

POMEROY (A. W. J.). **Report of the Medical Entomologist.**—*Rep. Med. Sanit. Dept. Gold Coast 1929–30*, pp. 121–129, 1 chart. Accra, 1930.

A tsetse-fly survey has been made of the coastal area of the Eastern Province of the Gold Coast Colony, as it is proposed to develop cattle-

breeding in this region. The only species of *Glossina* found was *G. palpalis*, R.-D. Game is practically absent, and the food-supply of the fly consists of domestic animals, man and, occasionally, reptiles. During the dry season it occurs only along the banks of the Volta or where there are permanent pools in the smaller streams, and the incidence is reduced to a minimum. During the rainy season, however, there is a consistent history of high incidence, which is obviously due to migration from the upper reaches of the river. When the water rises and floods the terrain, *G. palpalis* is dispersed over a wide area, migrating to secondary breeding-places, such as the thickets surrounding depressions that hold water for two or three months. It seems likely that if the vegetation along the smaller streams belonging to the coastal drainage area were cleared, the fly would disappear, but the country would be rendered more arid and the streams would dry up even more rapidly in the dry season. The control of the fly in this area should be easy, but the lack of population, the necessity for conserving the water-supply and the high cost of labour may outweigh the economic advantages of destroying the fly, particularly as it has yet to be proved that indigenous or even half-bred cattle suffer any serious loss from trypanosomiasis. It is suggested that clearing in the area that drains into the Volta, where the vegetation along the streams becomes increasingly dense towards the main river, would not be an economic proposition.

In the second part of this report the author gives a summary of the work of the main tsetse organisation from 1925–29 [*cf. R.A.E.*, B, xvii, 150 ; xviii, 218]. The habitats and distribution of the various species of tsetse found in the Gold Coast are discussed. It is pointed out that, whereas *G. palpalis* and *G. tachinoides*, Westw., may be found in equal numbers in certain localities, the absence or preponderance of one or other of these species appears to be due to geological factors. *G. tachinoides* prefers a sandy, stony terrain, with a flow of water, and is consequently found where vegetation is slight and suitable breeding-places are available in the shelter of large rocks. In the optimum habitat of *G. palpalis* the presence of water is combined with moist loam soil or clay, this fly being dependent on a much denser vegetation and consequent humidity. *G. palpalis* appears to exercise a definite choice of position when depositing its larvae, and in many cases a few large, fallen logs have been selected in a considerable area, as many as 60 pupal cases having been found under one log. This may prove of importance in artificial control, as it was observed after clearing that considerable pupation took place under the piles of unburnt logs and brushwood that remained. Thus early clearing and later burning would probably destroy large numbers of pupae from larvae deposited by the fly in the only available situations after its natural haunts had been removed. The partial clearing of forest country results in a definite increase in the incidence of *G. palpalis*. In the dense forest of Ashanti it has not been found except on the fringes of clearings. In laboratory experiments carried out with this fly during August-October 1928, it was found that the minimum period between the depositions of larvae was 6 days, the maximum 17 and the average 10. The maximum numbers of gravid females in both *G. palpalis* and *G. tachinoides* were taken in December, at the end of the rainy season.

It appears that clearing measures have had a definite effect in reducing trypanosomiasis in cattle on the cattle route [xviii, 218]. Owing to the distribution and bionomics of tsetse in the Gold Coast, it is possible to

control them by clearing and burning, provided that efforts are confined to definite objectives such as cattle routes, isolated villages bounded by clearly defined limits of infestation, and cattle-breeding areas where *G. palpalis*, and to a certain extent *G. tachinoides*, are the species involved.

MORRIS (K. R. S.). **Report on certain Tsetse Fly Areas of the Northern Territories.**—*Rep. Med. Sanit. Dept. Gold Coast 1929–30*, pp. 130–158, 4 pls., 3 maps, 4 charts. Accra, 1930.

A very detailed account is given of the bionomics, distribution and ecology of tsetse-flies on the northern part (first 90 miles) of the eastern cattle route in the Gold Coast, with descriptions of six clearings that were made during 1929 at places where the road passes fly-belts [*cf.* *R.A.E.*, B, xviii, 219]. The vegetation and fly-belts on the same route 6 miles north of Yeji ferry are also discussed, together with the clearing and burning carried out in this area from January to March 1930, and the effect of these measures on the incidence of the fly in the various localities.

Glossina morsitans submorsitans, Newst., has been found to feed almost exclusively on the larger antelopes, and its distribution appears to be limited by the presence of these animals. Observations on the distribution of *G. tachinoides*, Westw., have led the author to conclude that its preferred hosts are reptiles ; this would explain the fact that it is frequently found close to the water's edge where cover is scanty and that it has not been found along small streams where reptiles are rare or absent. On the other hand game may form the major part of its diet when reptiles are scarce. Man is never a preferred host. *G. palpalis*, R.-D., is less restricted with regard to hosts, though it appears to prefer smaller game animals and probably feeds to a considerable extent on small mammals, rodents, etc. It does not exhibit any preference for man or reptiles, and birds may act as hosts when others are scarce or absent.

With regard to the conclusions based on clearing experiments, it is pointed out that a careful survey of the conditions of the fly-belt seems to be justified in order to determine the amount of clearing necessary to reduce the numbers of the fly to a point where it is negligible as a vector of disease. In making small clearings for the control of *G. palpalis* and *G. tachinoides*, it is recommended that all trees should be removed, as temporary fly-belts may easily be formed where there is overhead shade, even though it is scanty, provided that there is abundant low cover. Without high overhead shade the formation of permanent or temporary fly-belts is impossible. Moreover, ground completely cleared of trees dries much more quickly than ground shaded by trees even if they are scattered, and as primary tsetse foci always occur on fairly moist ground, this process is of importance. For this reason it is important to start clearing as soon as the subsidence of floods and rivers will allow (about November or December), so that the cut wood can be thoroughly dried and burned at least a month before the onset of the rains ; tree stumps and any vegetation not destroyed by burning will then be subject to the full desiccating effect of the dry weather before the first rainfall enables them to recover. In one locality tree stumps that had been subjected to burning and then to complete immersion for about three months during the floods were found to have been killed completely, and it would thus appear that the task of removing all tree

roots can be dispensed with, provided that burning is controlled and efficiently carried out, and that the river bank is subject to flooding during the rains.

WALLACE (J. M.). **Micro-organisms in the Gut of** *Glossina palpalis*.—*Ann. Trop. Med. Parasit.*, xxv, no. 1, pp. 1–19, 20 refs. Liverpool, 31st March 1931.

The author gives an account of experiments and observations on the micro-organisms found in the gut of *Glossina palpalis*, R.-D. He concludes that the long bacilli noticed by some authors [*cf.* *R.A.E.*, B, xvii, 44] are probably identical with the symbionts or intra-cellular bacteroids discussed by others [*cf.* vii, 174] that are present in every fly, and points out that the incompatibility believed to exist between the long bacilli and trypanosomes is apparent only, and due to the methods used in demonstrating the former. The low percentage of flies that have been found to harbour them [xvii, 44] is explained by the localised area of the gut in which the giant cells containing them are found, and the consequent possibility of missing this area, with the result that the bacilli are not liberated when the gut is teased up. In 6·6 per cent. of a series of wild flies dissected *Trypanosoma grayi* was found and in every case bacteroids was also present. Attempts were made to cultivate the bacteroids on various media without success.

Unfed laboratory-bred flies were fed on blood infected with known bacteria, and the bacteria were afterwards recovered in cultures from the gut of the flies. The duration of the " infection " is shown to vary with different organisms, and with some a point was reached when no further positive cultures were obtained. The longest time that an " infection " remained in a fly without killing it was 30 days. Evidence is given to show that tsetse-flies do not pick up bacterial infection even from grossly contaminated surroundings, and the extreme cleanliness of the cages sometimes advocated in transmission experiments is therefore not essential. Cultures from numbers of flies show that during life the gut is apparently free from micro-organisms other than the bacteroids.

HAMLYN-HARRIS (R.). **The Elimination of** *Aëdes argenteus* **Poiret as a Factor in Dengue Control in Queensland.**—*Ann. Trop. Med. Parasit.*, xxv, no. 1, pp. 21–29, 9 refs. Liverpool, 31st March 1931.

Dengue in Australia is confined to the north-east, extending as far south as the northern portions of New South Wales [*R.A.E.*, B, xvi, 193]. The economic loss in wages and efficiency due to it is briefly discussed. It is not endemic in Australia, as no cases occur between the outbreaks, and it is suggested that the epidemics may originate in India and Ceylon and reach Australia by way of such countries as China and Malaya. The vector, *Aëdes argenteus*, Poir., is spreading to all the inland towns in Queensland, following the railway lines. An intensive campaign tends to force it to forsake its natural habitats and frequent such breeding-places as flower pots in " bush " houses, etc. It selects horse troughs, gutters, provided that they are cemented, and even gully traps, if the water is not polluted ; occasionally it may be found in water on the ground, but this is exceptional [*cf.* xv, 164]. Although it hibernates mainly in the egg stage, numbers of adults pass the winter

in warm secluded spots, and the larvae and pupae are capable of surviving the winter in Queensland if the water-holding rubbish in which they breed is sheltered. In Brisbane it was found that the larvae lie on the bottom of the receptacle during the colder parts of the day (temperature about 43–60° F.) and become active again with an increase of temperature (62–76° F.). The eggs are capable of surviving prolonged desiccation, although under favourable conditions they usually hatch within three days. They are frequently laid in roof gutters immediately after periods of rain and if, owing to dryness, they remain attached to the sides, a storm may carry them into the tank where they hatch within a day or so. A survey of cavities in trees in public thoroughfares and of vessels in cemeteries indicates that *A. argenteus* has a small range of flight, and as a rule will only select breeding places in the immediate vicinity of its blood supply [xvii, 63; xix, 119].

The value of house to house inspections is demonstrated by the fact that in three areas the percentage of places needing control was reduced from 51·7, 70·5 and 44·5 to 17·8, 6·0 and 3·9 respectively on re-inspection.

Evans (A. M.). **Notes on African Anophelines.**—*Ann. Trop. Med. Parasit.*, xxv, no. 1, pp. 129–143, 6 figs., 7 refs. Liverpool, 31st March 1931.

As a result of examination of further material *Anopheles marshalli* var. *moucheti*, Evans, and *A. marshalli* var. *hargreavesi*, Evans, are raised to specific rank. Notes are given on the adult characters of the former, and on all stages of the latter [*cf. R.A.E.*, B, xviii, 52]. The larvae of *A. hargreavesi* were found in southern Nigeria breeding in water contaminated with sewage and covered with *Pistia*, both in the sun and in partly shaded places, among *Pistia* in clear water in more open jungle areas, and among grass growing in swamps. Descriptions are given of the characters distinguishing the adults of *A. marshalli* var. *keniensis*, n., which was obtained in Kenya, and all stages of *A. moucheti* var. *nigeriensis*, n., which was bred from larvae taken in southern Nigeria in clear water containing grass or *Pistia* and other vegetation. The fourth stage larva and the egg of *A. obscurus*, Grünb., are described from southern Nigeria.

Mulhearn (C. R.). **Oils suitable as Vehicles for Sheep Blowfly Dressings. Trials at Nyngan Experiment Farm.**—*Agric. Gaz. N.S.W.*, xl, pt. 12, pp. 905–913. Sydney, December 1929.

Mulhearn (C. R.). **Dressings for Fly-struck Sheep. Trials at Nyngan Experiment Farm.**—*Op. cit.*, xlii, pt. 3, pp. 223–234. Sydney, March 1931.

In the first paper experiments carried out in New South Wales are described in which various oils were applied to the wool and skin of sheep to determine their penetrating value, adhesiveness and durability in the wool, in order to ascertain the most suitable base for a dressing for use on sheep infested with blowflies. The oils that proved most suitable were olive oil, which is too expensive for use on a large scale, fish oil, herring oil and whale oil, which are about equal in value, though the first two are slightly irritating to the skin of the back and the last is less durable on the crutch, and neatsfoot oil and cottonseed oil, which

are not so penetrating or durable as the others. The mineral oils generally, and the finer ones in particular, are irritating to the skin of the sheep, and the thicker ones cause matting of the wool.

In the second paper an account is given of experiments with various substances, including some proprietary preparations, to test their value as dressings. The author concludes that the most satisfactory material was a 5 per cent. aqueous solution of Monsol. This dressing penetrates and runs through the wool comparatively well and, besides being effective in removing the larvae, has an astringent action that aids in healing the wounds and preventing re-infestation. The best oily dressing used was 4 per cent. phenol crystals in whale oil, with the addition of either 5 per cent. carbon tetrachloride or 2–4 per cent. oil of chenopodium as a repellent. When slight or moderate infestations are to be dealt with, the solution of phenol in whale oil is adequate, but in more serious cases a repellent should be added. A 5 per cent. aqueous solution of zinc sulphate is also effective, but does not penetrate or run through the wool so well as an oily dressing. This disadvantage can be overcome to a certain extent by applying it with a small hand spray pump. Benzene kills the larvae most rapidly, but causes irritation. It might be used with advantage for killing maggots in obscure places, such as in deep wounds or behind the horns of rams, but should be followed by a soothing dressing, preferably with a repellent action, as it does not prevent re-infestation.

JOHNSON (C. W.). **Nestling Birds destroyed by the Larvae of** *Protocalliphora.—Bull. Boston Soc. Nat. Hist.*, no. 59, pp. 21–24, 15 refs. Boston [Mass.], April 1931.

In this paper additional records are given of nestling birds being attacked by larvae of the genus *Protocalliphora* in Massachusetts [*R.A.E.*, B, xvii, 133].

[GRÜNGARTEN (M. L.).] **Грингартен (М. Л.). Zur Frage über Ophthalmomyiasis.** [*In Russian.*]—*Trop. Med. Vet.*, viii, no. 8–9, pp. 30–39, 3 figs., 20 refs. Moscow, 1930. (With a Summary in German.)

An instance is recorded from near Moscow of the occurrence of an unidentified Dipterous larva (probably an Oestrid) in the frontal chamber of the human eye. The larva does not resemble that of any of the Oestrids previously recorded from man. The literature on flies causing various forms of myiasis in man is reviewed.

[ANANYAN (S. A.).] **Ананян (С. А.). The Experiment of interrupted Irrigation of Rice Fields as a Control Measure against Malaria in Armenia in 1928.** [*In Russian.*]—*Trop. Med. Vet.*, viii, no. 8–9, pp. 39–47, 3 diag., 14 refs. Moscow, 1930.

Further and more detailed experiments [*cf. R.A.E.*, B, xvii, 117] on interrupted irrigation of rice-fields for the control of mosquitos in Armenia show that the larvae were all killed after keeping the fields dry for 6 days, but after 4 days some living larvae were present in small pools of water and in cracks that still retained moisture. The author believes that the fields may be irrigated for 8–12 days, since in the laboratory the minimum period necessary for the development of

individual generations of Anophelines was 21 days in July, the hottest month of the year under review. Dusting the surface of the water with Paris green, 1 : 100, killed nearly all the mature Anopheline larvae, but was less effective against the young ones or those of *Culex*. Of the Anophelines breeding in rice-fields, 95 per cent. were *Anopheles maculipennis*, Mg., and 5 per cent. *A. hyrcanus* var. *pseudopictus*, Grassi. Although adults of *A. superpictus*, Grassi, were present in the rice-field area, they had probably come in from elsewhere, as no larvae were found there. Adults of *A. sacharovi*, Favr (*elutus*, Edw.) were also taken in the area.

BADGER (L. F.), DYER (R. E.) & RUMREICH (A.). **An Infection of the Rocky Mountain Spotted Fever Type. Identification in the Eastern Part of the United States.**—*Publ. Hlth. Rep.*, xlvi, no. 9, pp. 463–470, 6 refs. Washington, D.C., 27th February 1931.

In connection with studies of cases of a disease resembling typhus or Rocky Mountain spotted fever, occurring in the eastern part of the United States [see next paper], strains of virus apparently closely related to, or identical with, Rocky Mountain spotted fever from three cases in northern Virginia were established in guineapigs, and in monkeys and rabbits inoculated with guineapig passage virus. Tests with two of the strains showed no evidence of cross-immunity with endemic typhus [Brill's disease] or European typhus, but guineapigs that had recovered from the disease produced by the virus apparently developed a definite immunity from subsequent inoculations with the virus of Rocky Mountain spotted fever.

RUMREICH (A.), DYER (R. E.) & BADGER (L. F.). **The Typhus-Rocky Mountain Spotted Fever Group. An epidemiological and clinical Study in the Eastern and Southeastern States.**—*Publ. Hlth. Rep.*, xlvi, no. 9, pp. 470–480. Washington, D.C., 27th February 1931.

In the course of a study begun in April 1930 in connection with an investigation of endemic typhus [Brill's disease] in the eastern United States, it was noted that most of the cases in rural districts in the northern section of these States suffered from a very severe disease, which did not correspond clinically with endemic typhus [*cf. R.A.E.*, B, xv, 51 ; xvii, 228], but resembled Rocky Mountain spotted fever more closely than it did any other disease. A considerable proportion of these cases gave a history of tick bite within a short time preceding onset, and very few of them appeared to be associated with rodent infestation. A partial analysis was made of 100 selected cases divided into two groups, one of which consisted mainly of persons who had not left a city environment and were clearly affected with Brill's disease, and the other of cases of known or presumed rural origin, all suffering from a disease clinically indistinguishable from Rocky Mountain spotted fever and frequently following tick bite. The clinical features and epidemiological characteristics of the two diseases are discussed. There were no deaths in the typhus group, but seven in the Rocky Mountain spotted fever type group. Of 93 cases of the latter occurring in five States and in the District of Columbia in the spring and summer of 1930, 21 (22·6 per cent.) died.

Of the endemic typhus cases, 78 per cent. had occurred in close association with rats, although in only 16 per cent. of these had there

been actual contact with rats, and 8 per cent. had knowledge of being bitten by fleas within a short time preceding onset. Bites by bedbugs and by undetermined insects totalled 6 per cent. each. One patient was infested with lice. Live rats and nests obtained from four premises at which cases had occurred were found to be infested with the fleas, *Xenopsylla cheopis*, Roths., and *Ceratophyllus fasciatus*, Bosc, and the rat mite, *Echinolaelaps* (*Laelaps*) *echidninus*, Berl., which, however, is not known to attack man.

In the Rocky Mountain spotted fever type group, a definite history of tick bite within three weeks prior to onset was elicited in 48 per cent. of cases. In 6 per cent., patients had crushed engorged ticks removed from dogs. The remainder had all occurred under conditions in which tick bite was possible. Bites by other Arthropods totalled 16 per cent., of which half also gave a history of tick bite. The seasonal distribution of cases of this disease corresponded approximately with the duration of the tick season and roughly with the relative prevalence of ticks. In three of the focal areas, a systematic collection of ticks showed the predominant species to be *Dermacentor variabilis*, Say, and *Amblyomma maculatum*, Koch, and *A. americanum*, L., were occasionally obtained. Whereas in the endemic typhus series no secondary cases occurred in any family, in the Rocky Mountain spotted fever group two or three cases occurred in each of three households.

NICOLLE (C.) & ANDERSON (C.). **Rapport sur les spirochètes des fièvres récurrentes, transmises par les tiques.**—*Arch. Inst. Pasteur Tunis*, xix, no. 4, pp. 469–477. Tunis, 1930.

The authors discuss the classification of the various tick-borne spirochaetes that cause relapsing fever in man. They conclude that specific determination by morphological characters, the effect of the infection on man, or agglutination or cross-immunity tests is impossible, and should be replaced by division into groups according to the symptoms produced in various laboratory animals on lines indicated.

DOWNHAM (K. D.). **Three Types of Acari isolated from Pigs affected with Sarcoptic Mange.**—*Vet. J.*, lxxxvii, no. 4, pp. 200–202. London, April 1931.

Investigation of an outbreak of dermatitis in pigs in England revealed the presence of *Sarcoptes suis*, Gerl., which caused typical sarcoptic mange on the lower surface of the body, *Tyroglyphus* sp. (a mite of the so-called non-pathogenic group), which caused lesions on the upper surface, and in addition a Tarsonemid, probably *Pediculoides ventricosus*, Newp.

YAMADA (S.). **Observations on a House-infesting Mite (*Liponyssus nagayoi*, n. sp.) which attacks Human Beings, Rats and other domestic Animals, with brief Notes of Experiments regarding the Possibility of the Plague-transmission by means of the Mite.**—*Dobuts. Zasshi*, xliii, pp. 237–249, 3 figs. Tokyo, 15th April 1931.

Liponyssus nagayoi, sp. n., the female of which is described, was first recorded in Japan in 1926 and has since been found in various parts of the country and in Korea. Rats are the chief hosts of the

mites, which also attack man and other mammals, but not birds. They are found in enormous numbers in infested dwellings. They bite both by day and night. The adults of both sexes and the protonymphs, all of which suck blood, crawl quickly, and the dormant stages, the larvae and deutonymphs, move slowly when disturbed but do not feed. To obtain a full meal the adults require 1–3 hours and the protonymphs, which engorge only once, 9–18. The adults feed several times, the interval between feeds varying according to temperature. When fully fed, they leave the host. The bite may produce a large vesicle and intense irritation. In winter the females can live for 92 days without food, the males for 74, and the protonymphs for 34. The mites are active from April to November and particularly so in summer. At 40° C. [104° F.] in an incubator both sexes died. The optimum temperature appears to be 22° C. [71·6° F.], but oviposition and development continued in November at 10–13° C. [50–55·4° F.]. Below this temperature feeding, but not oviposition, occurred. In an unheated room in winter all activity ceases.

Plague bacilli were found in crushed mites from mice suffering from the disease, and mites harboured the bacilli for 7 days (the latest test made) after feeding. Mites from an infected mouse crushed in the mouth of healthy mice induced the disease, and mites from infected rats and mice introduced into the cages of healthy ones produced plague in one mouse out of three and in two rats out of five.

[Dryenski (K.).] **Дрѣнски (К.). Die Kugelbauchmilbe** *Pediculoides ventricosus* **Newp. und die "Copra-Itch" -Krankheit in Bulgarien.** [The Mite, *P. ventricosus*, and the "Copra-Itch"-Disease in Bulgaria.] [*In Bulgarian.*]—*Mitt. bulgar. ent. Ges.*, vi, pp. 94–97, 3 figs. Sofia, 1931. (With a Summary in German.)

A brief account is given of an outbreak of dermatitis caused by *Pediculoides ventricosus*, Newp., among persons handling barley grain, in which the mites were numerous. Brief notes on the bionomics of the mite, which is very common in Bulgaria, especially in the southern districts, are given [*cf. R.A.E.*, A, xiv, 564]. It usually attacks insect pests of stored grain, and a female may give rise to as many as 280 young. The time required for the development of a female varies from 6 days at 32–37° C. [89·6–98·6° F.], to 13 days at 15–21° C. [59–69·8° F.]. At 10° C. [50° F.] development is stopped. Sometimes the mites infest the grain itself and pass from it to man.

[Dryenski (P.).] **Дрѣнски (П.). Kleine entomologische Mitteilungen.** [Brief entomological Notes.] [*In Bulgarian.*]—*Mitt. bulgar. ent. Ges.*, vi, pp. 123–141, 6 figs., 3 refs. Sofia, 1931.

In one section of this paper, brief notes are given on the Anophelines occurring in the valley of the river Struma, which have already been recorded from Bulgaria [*R.A.E.*, B, xvii, 219]. *Phlebotomus papatasii*, Scop., is also very numerous and is responsible for sandfly fever. The hot weather and abundance of water in this part of the country favour the breeding of Tabanids, which are serious pests of cattle in many places with excellent pasture land. A list is given of 20 species occurring in the south-west of Bulgaria. The wasps, *Bembex mediterranea*, Hndl., and *B. rostrata*, L., prey upon the adult Tabanids.

Fox (C.). **A limited Rat Flea Survey of Savannah, Ga.**—*Publ. Hlth. Rep.*, xlvi, no. 11, pp. 574–575. Washington, D.C., 13th March 1931.

In the course of a rat-flea survey carried out during February-March and September-October 1927, the following fleas were found on the rats, all of which were *Mus* (*Rattus*) *norvegicus*: *Xenopsylla cheopis*, Roths., *Ceratophyllus fasciatus*, Bosc, *Leptopsylla segnis*, Schönh. (*musculi*, Dug.), *Echidnophaga gallinacea*, Westw., *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., and *C.* (*C.*) *felis*, Bch. A marked increase in the number of fleas per rat noted in the autumn months was due solely to an increase in the numbers of *X. cheopis*. *Ceratophyllus fasciatus* practically disappeared in September and October. The incidence of *L. segnis* was relatively high.

Pettit (R. H.). **Report of the Section of Entomology [1927–28].**—*Ann. Rep. St. Bd. Agric. Michigan 1927–28*, reprint 20 pp., 11 figs. [East Lansing, Mich., 1928.] [Recd. 1931.]

An instance is recorded of *Haemaphysalis chordeilis*, Pack., infesting the heads of turkeys in Michigan. The latter had undoubtedly become infested in the woods where they had been allowed to run, and the ticks were so numerous that they had to be removed by hand. It is stated that this tick occasionally becomes a serious pest and has been known to kill young turkeys.

Sergent (Edm.), Donatien (A.), Parrot (L.) & Lestoquard (F.). **Transmission héréditaire de** *Piroplasma bigeminum* **chez** *Rhipicephalus bursa*. **Persistance du parasite chez des tiques nourries sur des chevaux.**—*Bull. Soc. Path. exot.*, xxiv, no. 3, pp. 195–198, 2 refs. Paris, March 1931.

Experiments in Algeria in 1929 and 1930 showed that infection with *Piroplasma bigeminum* is hereditary in *Rhipicephalus bursa*, C. & F., and that ticks of the second generation can transmit the infection in the larval stage. Moreover, hereditarily infected ticks that had engorged in the larval-nymphal stage on horses, which are not susceptible to the piroplasm, transmitted it to cattle as adults. Attacks of true piroplasmosis following infection from *R. bursa* are generally mild.

Roberts (F. H. S.). **The Buffalo Fly (*Lyperosia exigua* de Meijere).**—*Queensland Agric. J.*, xxxv, pt. 3, pp. 163–166, 1 fig. Brisbane, March 1931.

In view of its recent introduction into Queensland, a brief account is given of the bionomics of *Lyperosia exigua*, de Meij. (buffalo fly), which is a pest of domestic animals in the Northern Territory. Much of the information has already been noticed [*cf. R.A.E.*, B, vi, 118; xiv, 108; xix, 89]. Attempts to breed the flies under natural conditions from the dung of horses, kangaroos, wallabies, etc., have been unsuccessful, and it appears that this type of dung is too dry for the development of the larvae. *L. exigua* is present throughout the year, but exhibits a very marked seasonal variation. During the dry winter months it is so scarce that it is difficult to find, but at the beginning of the rainy season in November it becomes more numerous, reaching its maximum numbers in the wet months of January and February and gradually becoming less common towards May and June.

ROBERTS (F. H. S.). **The Occurrence of a Beetle (*Onthophagus granulatus* Boh.) in the Stomach of domesticated Animals.**—*Queensland Agric. J.*, xxxv, pt. 3, p. 171. Brisbane, March 1931.

The author records the presence of large numbers of the Coprid, *Onthophagus granulatus*, Boh., in the stomachs of a horse and calves in Queensland. Though in the case of the calves sufficient details are not available to prove that death was directly due to the infestation, in the case of the horse at least the stomach was so extensively perforated that large quantities of the contents had escaped. The method of infestation is not known; the eggs, larvae or adults may be ingested, but as beetles have been observed clinging to the anus of horses, it seems more likely that they are attracted thither when the animal is lying down and, having gained entrance, work their way up to the stomach [*cf.* *R.A.E.*, B, xvi, 251]. Little is known of the habits of *O. granulatus* except that it is found frequenting dung.

SIMIĆ (Č.). **Etude complémentaire des phlébotomes de Skoplje (Yougoslavie).**—*Ann. Paras. hum. comp.*, ix, no. 2, pp. 104–110, 2 figs., 5 refs. Paris, March 1931.

In view of the fact that in previous work on the sandflies of Skoplje [*R.A.E.*, B, xviii, 186] *Phlebotomus chinensis*, Newst., was confused with *P. perniciosus*, Newst., a further study was made of the biology and systematic position of sandflies collected at Skoplje in outhouses during the day and on the verandah by artificial light at night. The percentages of males captured in the two situations was practically the same; of 220 individuals 10 were *P. major*, Annan., 18 *P. papatasii*, Scop., 22 *P. perniciosus*, and 170 *P. chinensis*, Newst. Of the females 1 was *P. papatasii*, 12 were *P. major* and 217 *P. chinensis*. The absence of females of *P. perniciosus* and the scarcity of those of *P. papatasii* is probably attributable to the biology of these species. Both males and females of *P. major* and *P. chinensis* are attracted at night to artificial light, and the females bite in the light whether inside or outside the house. During the day both sexes rest outside the bedrooms, preferably in outhouses. Although numbers of males of *P. papatasii* may be found inside houses, few are attracted to lights on the verandah. During the day the males are less often found outside bedrooms. The females of this species prefer to bite inside and in the dark, sheltering during the day in the bedrooms where they have fed. It is suggested that the biology of *P. perniciosus* is similar to that of *P. papatasii*. The characters distinguishing these species are discussed.

PAPERS NOTICED BY TITLE ONLY.

SIMMONS (J. S.). **Dengue Fever.**—*Amer. J. Trop. Med.*, xi, no. 2, pp. 77–102, 8 figs., 30 refs. Baltimore, Md., March 1931. [*Cf.* *R.A.E.*, B, xix, 110.]

BONNE-WEPSTER (J.). **Het geslacht *Taeniorhynchus* Arribalzaga in N.O.I. Tweede gedeelte.** [The Genus *Mansonia* (*Taeniorhynchus*) in the Netherlands East Indies. Part II. Subgenus *Coquillettidia*, with Key.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxi, no. 3, pp. 260–276, 3 figs. Batavia, March 1931. Also in English in *Meded. Dienst. Volksgezond. Ned.-Ind.*, Foreign Edn., xix, no. 3, pp. 387–399, 3 figs. Batavia, 1930.

GALLIARD (H.). *Culex brumpti*, **n. sp. Moustique nouveau trouvé en Corse.**—*Ann. Paras. hum. comp.*, ix, no. 2, pp. 134–139, 4 figs., 4 refs. Paris, March 1931.

COULON (G.) & DINULESCU (G.). **Un cas de myiase oculaire à** *Oestrus ovis* **L. en Corse.**—*Ann. Paras. hum. comp.*, ix, no. 2, pp. 140–143, 7 figs. Paris, March 1931.

COLAS-BELCOUR (M. C. & J.). **Présence de** *Phlebotomus perniciosus* **Newstead dans le département du Calvados.**—*Bull. Soc. linn. Normandie*, (8) ii (1929), pp. 4–6, 2 refs. Caen, 1930.

HOFFMANN (C. C.). **Estudios entomológicos y parasitológicos acerca de la Onchocercosis de Chiapas.** [Entomological and parasitological Studies on Onchocercosis in the Chiapas Zone of Mexico.]—*Salubridad*, 1930, no. 3, reprint 31 pp., 23 figs. Mexico, 1931. [*Cf. R.A.E.*, B, xviii, 213, 216, 271 ; xix, 113.]

KRÖBER (O.). **Die Tabaniden Neuseelands.** [The Tabanids of New Zealand.]—*Stettin. ent. Z.*, xcii, no. 1, pp. 58–89, 12 figs. Stettin, 1931.

KRÖBER (O.). **Neue Tabaniden aus Südamerika.** [New Tabanids from S. America.]—*Stettin. ent. Z.*, xcii, no. 1, pp. 90–93. Stettin, 1931.

KRÖBER (O.). **Neue Arten aus dem Genus** *Esenbeckia* **Rond. (Dipt. Tabanidae).** [New Species of *Esenbeckia* from South America.]—*Zool. Anz.*, xciv, no. 9–10, pp. 245–257, 7 figs. Leipzig, 20th May 1931.

KRÖBER (O.). **Die Pelecorhynchinae und Melpiinae Südamerikas (Dipteren, Tabanidae).**—*Mitt. zool. Mus. Hamburg*, xliv, pp. 149–196, 33 figs., 41 refs. Hamburg, 1931.

NIESCHULZ (O.). **Ueber die Puppen von** *Tabanus ceylonicus*, *T. minimus* **und** *T. fumifer*.—*Zbl. Bakt.* (2), lxxxiii, no. 8–14, pp. 120–125, 2 figs., 4 refs. Jena, 16th March 1931.

CARRIÓN (A. L.). **Final Report on a Rat-flea Survey of the City of San Juan, Porto Rico.**—*Porto Rico J. Publ. Hlth. Trop. Med.*, vi, no. 3, pp. 273–282, 5 charts, 4 refs. San Juan, P.R., March 1931. [Summary of previous reports, *R.A.E.*, B, xvi, 163 ; xvii, 26 ; xviii, 163.]

FALKE (H.). **Beiträge zur Lebensgeschichte und zur postembryonalen Entwicklung von** *Ixodes ricinus* **L.** [Contribution to the Life-history and postembryonic Development of *I. ricinus*.]—*Z. Morph. Oekol. Tiere*, xxi, no. 3–4, pp. 567–607, 25 figs., 55 refs. Berlin, 1931.

KEMPER (H.). **Beobachtungen über die Wirkung von Insektenstichen.** [Observations on the Reaction of the Human Skin to Insect Bites.]—*Arch. Derm. Syph.*, clxi, no. 1, pp. 127–145, 6 figs., 1 p. refs. Berlin, 1930.

NAGAYO (M.) & others. **On the Virus of Tsutsugamushi Disease** [*Rickettsia orientalis*, sp. n.] **and its Demonstration by a new Method.**—*Jap. J. Exptl. Med.*, viii, no. 4, pp. 309–318, 2 pls. Tokyo, August 1930.

NAGAYO (M.) & others. **Ueber den Nachweis des Erregers der Tsutsugamushi-Krankheit, der** *Rickettsia orientalis*. [On the Demonstration of *R. orientalis*, the Causal Agent of Tsutsugamushi Disease.]—*Jap. J. Exptl. Med.*, ix, no. 2, pp. 87–150, 13 pls. Tokyo, March 1931.

Nitzulescu (V.). **Contribution à l'étude des phlébotomes du groupe** *minutus*, *P. parroti* **et** *P. minutus* **str. sensu.**—*Ann. Paras. hum. comp.*, ix, no. 2, pp. 111–121, 11 figs. Paris, March 1931.

An examination of a small collection of sandflies of the group of *Phlebotomus minutus*, Rond., from Europe showed that the specimens from southern France, Spain, Crete and Greece were *P. parroti*, Adl. & Theo., so that this species also occurs in the eastern basin of the Mediterranean [*cf.* *R.A.E.*, B, xix, 11]. A single male from Salonika proved to be *P. minutus*, Rond., a species that has not previously been known from Europe. Further details are given of the characters distinguishing these species [*cf.* xiv, 96 ; xv, 113].

Nitzulescu (G.) & Nitzulescu (V.). **Essai de table dichotomique pour la détermination des phlébotomes européens.**—*Ann. Paras. hum. comp.*, ix, no. 2, pp. 122–133, 15 figs., 20 refs. Paris, March 1931.

The literature on the classification of the European species of *Phlebotomus* is briefly discussed, and keys are given for the identification of the males and females. The key to the males includes *P. chinensis* var. *simici*, n., from Jugoslavia [*cf.* *R.A.E.*, B, xix, 172]. *P. chinensis* var. *longiductus*, Parrot, is also regarded as a distinct variety. The technique used in making preparations for the identification of the species of *Phlebotomus* is described.

Stanford (J. S.). **Notes on Diptera attacking Man in Sevier County, Utah.**—*Pan-Pacific Ent.*, vii, no. 3, pp. 99–100. San Francisco, Cal., January 1931.

Diptera recorded as attacking man are *Aëdes dorsalis*, Mg., *A. campestris*, D. & K., *A. vexans*, Mg., *Culex tarsalis*, Coq., *Symphoromyia hirta*, Johnson, *Silvius quadrivittatus*, Say, *Chrysops fulvaster*, O.S., and *Culicoides varipennis*, Coq.

Roubaud (E.) & Gaschen (H.). **Sur l'adaptation zoophile de l'***Anopheles maculipennis*.—*Bull. Soc. Path. exot.*, xxiv, no. 3, pp. 203–209, 1 fig., 1 ref. Paris, March 1931.

Comparative studies of the maxillary armature and fecundity of females of *Anopheles maculipennis*, Mg., some from Morocco and belonging to the north African type feeding essentially on man, and others from western France and showing a preference for domestic animals, indicate that a preference for feeding on animals as expressed in an increased number of teeth in the maxillae corresponds with a markedly more abundant production of eggs as shown by dissection. Among *A. maculipennis* feeding on man, the productivity of the females rarely exceeds 200 eggs, whereas among those feeding on animals in western France and northern Italy as many as 371 eggs were observed in one female.

It appears evident that zootropic adaptation, when carried to extreme limits, as in the stabilised agricultural regions of western Europe, has resulted in providing for the mosquitos food that is not only more available, but more widely distributed and more abundant. This has in turn produced a degree of fecundity more favourable to the species.

(19120) Wt P2/3550 1,700 8/31 H & Sp Gp 52

Roubaud (E.). **Nouvelle contribution à l'étude du zootropisme anophélien** (*A. maculipennis*).—*Bull. Soc. Path. exot.*, xxiv, no. 3, pp. 229–246, 7 figs., 3 refs. Paris, March 1931.

In continuation of previous observations on the stable and unstable zootropic races of *Anopheles maculipennis*, Mg., already noticed [*R.A.E.*, B, xvi, 210], the results of work in la Vendée from 1928 to 1930 are given. Studies of larval dispersion in 1928, when the rainless summer had dried up all the temporary pools, and in 1930, when the continual rain caused the formation of a huge temporary marsh, confirmed the theory that large surfaces of water produce a numerous Anopheline fauna, larval development always tending to spread itself over the largest possible areas. Instability in the number of teeth on the maxillae in the local fauna has been found to be accompanied by a marked instability in the expression of its zootropic affinities. Observations have shown that variations in the area of water surfaces result in variations in the conditions of zootropism and irregularity in the maxillary armature of the fauna by favouring or checking the development of the less well-equipped mosquitos liable to attack man. Observations are recorded supporting the theory that a maximum development of water surface corresponds with a maximum development of mosquitos having a small number of teeth, whereas reduced water surface involves a greater preponderance of those having a high maxillary index (15 or more teeth). It is shown that, among a zootropic fauna, individuals with a poor maxillary armature feed with more difficulty on animals and produce a smaller number of eggs. In a free zootropic fauna originally inclined to attack animals, many females with a poor maxillary armature never achieve oviposition at all.

A comparison of the data obtained from year to year appear to show that zootropic evolution tends towards the suppression of individuals with few teeth, which constitute the great majority in Anopheline populations attacking man by preference. Considerable justification exists for believing that these individuals are more likely than others to assure their existence at the expense of man and above all to multiply partial blood-feeds in one and the same place before leaving it to lay their eggs. They are thus dangerous in regard to malaria, and lack of stability in the extent and disposition of water surfaces is a factor that allows them to develop more freely under certain seasonal conditions among a fauna better adapted to animals.

Baisas (F. E.). **The** *barbirostris-hyrcanus* **Group of the Philippine** *Anopheles*.—*Philipp. J. Sci.*, xliv, no. 4, pp. 425–448, 3 pls., 7 figs., num. refs. Manila, 1931.

The following is taken largely from the author's summary: The present study is an attempt to treat systematically both the larvae and adults of the Anophelines of the *barbirostris-hyrcanus* group that occur in the Philippines, namely *Anopheles barbirostris*, Wulp, *A. bancrofti* var. *pseudobarbirostris*, Ludl., *A. hyrcanus* var. *sinensis*, Wied., and *A. hyrcanus* var. *nigerrimus*, Giles. As a result, it has been shown that the Philippine forms do not exactly correspond to the descriptions given for the same forms in other countries. The main points of differentiation in both the larvae and adults are given. A discussion of the available literature, as a basis of comparison with the Philippine species, is also included.

Green (R. T. B.). **A malarial Parasite of *Macacus cynomolgus* and its Development in Mosquitoes. (Preliminary Note.)**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiv, no. 6, pp. 649–650. London, April 1931.

Experiments were undertaken to determine the insect vectors of a malarial parasite discovered in two monkeys (*Macacus cynomolgus*) in Malaya in 1930. Mosquitos fed on naturally infected monkeys gave negative results, possibly because the blood contained too few gametocytes. In experiments carried out with inoculated animals at the period when the gametocytes were numerous, females of *Anopheles maculatus*, Theo., and *A. kochi*, Dön., bred from larvae in the laboratory and fed once on an infected monkey, developed sporozoites in the salivary glands. *A. vagus*, Dön., showed only oöcysts. As many as 26 large oöcysts were found in one individual of *A. kochi* that had fed 9 days previously on a monkey the blood of which contained 220 gametocytes per cubic millimetre. Experiments with *Culex fatigans*, Wied. (*quinquefasciatus*, Say), *Armigeres obturbans*, Wlk., and *Aëdes* (*Stegomyia*) *albopictus*, Skuse, gave consistently negative results. Blood-sucking lice from the monkeys were free from infection.

In appearance and rate of development the oöcysts were indistinguishable from those of *Plasmodium vivax.* Large numbers of sporozoites were found in the salivary glands as early as the sixteenth day. No differences were discovered that would distinguish them from those of the parasites of human malaria. In view of the fact that *M. cynomolgus* is widely distributed in Malaya and that a large number of the monkeys are probably infected with malarial parasites that are capable of infecting Anopheline mosquitos, caution is necessary before attaching importance to the finding of oöcysts and sporozoites in Anophelines living under natural conditions.

Covell (G.). **The present State of our Knowledge regarding the Transmission of Malaria by the different Species of Anopheline Mosquitoes.**—*Rec. Malaria Surv. India,* ii, no. 1, pp. 1–48, 139 refs. Calcutta, March 1931.

In a previous paper, the author summarised the recorded data regarding the transmission of malaria by the different Anophelines up to the end of 1926 [*R.A.E.*, B, xvi, 41]. The purpose of the present paper is to review the existing position of knowledge on the subject and to bring the various records of dissections up-to-date. Certain records omitted in the previous paper are inserted, together with a list of corrections of errors that have since been discovered. Research during recent years has emphasised the fact that though very many species of *Anopheles* are possible vectors under certain conditions, the principal carriers in each locality are comparatively few and are often represented by a single species. A list is therefore given of the species considered to play the chief part in transmission in the various countries of the world.

Clyde (D.). **Report of the Control of Malaria during the Sarda Canal Construction (1920-1929).**—*Rec. Malaria Surv. India*, ii, no. 1, pp. 49–110, 8 pls., 1 map, 6 graphs. Calcutta, March 1931.

This account of the anti-malarial work carried out during the construction of the Sarda Canal System from 1920 to 1929 deals mainly, and in detail, with the notoriously malarious "Terai" zone of the United Provinces, in which the headworks of the Canal are situated.

Anopheles fuliginosus, Giles, the most common Anopheline, was found breeding in every type of water, pure or contaminated, stagnant or flowing. Breeding took place chiefly in October–November and May–June. *A. fuliginosus* var. *adiei,* James & List., the adults of which were not bred, was caught in nature chiefly in January each year. The larvae of *A. listoni,* List., were found mainly in various clear hill streams and ravines, and in backwaters of the Sarda River, both in grass-grown areas and behind boulders in relatively swiftly-flowing currents. They were also found in seepage holes in badly designed concrete drains, and boulder-strewn areas in the river bed, but never in completely stagnant water. They were most numerous from September to the beginning of November, but occurred in small numbers up to the middle of March. *A. minimus,* Theo., only appeared in the late autumn and invariably disappeared before the advent of the hot weather. After the rains in December and January, large numbers were bred from larvae collected from the grass-covered edges of the smaller streams. Adults of *A. willmori,* James, could always be found in huts, and the larvae were chiefly associated with sluggish streams and badly kept drains, especially in November and December when the working season had commenced. They showed a distinct preference for water exposed to sunshine and for the less contaminated swamps. Larvae of *A. maculatus,* Theo., were never found before the middle of November or after the beginning of April. They were found in exposed pools and in narrow, relatively fast-running streams obstructed by boulders. No larvae were ever found in shaded jungle streams or pools, or in pools in the sand of the river bed. *A. maculipalpis* var. *splendidus,* Koidz. (*indiensis,* Theo.) occurred throughout the year. The larvae were found in small numbers from October to the end of April in stagnant or slowly moving grass-edged waters, especially shallow marks, footprints and seepage pools exposed to light. Larvae were apparently never found in actual seepage channels, streams or drains. The larvae of *A. culicifacies,* Giles, occurred in small numbers in clean waters throughout the area, but were never numerous even in April when the adults were relatively abundant. No larvae or adults were found between the end of November and the beginning of February. In March and April the development of *A. maculatus, A. culicifacies* and *A. maculipalpis* var. *splendidus* from egg to adult took less than 6 days. The larvae of *A. barbirostris,* Wulp, were found in very small numbers in densely covered jungle swamps after the rains, but they disappeared when the undergrowth was cut and winter set in. *A. stephensi,* List., was found breeding on a few occasions in rain-water pools and in wells, but not in rain-water pools in the bed of the canal. *A. subpictus,* Grassi, formed 1 per cent. of the adult catches in winter and 5 per cent. in the hot weather.

It seems probable that the malaria occurring in autumn in this area is due to *A. listoni,* and that in spring to *A. maculatus* and *A. culicifacies* ; *A. fuliginosus, A. maculipalpis* var. *splendidus* and *A. willmori* apparently play little part in the transmission of the disease, though according to the literature they have all been experimentally infected. *A. listoni* and *A. culicifacies* occurred in large numbers in dwellings, and both bite during the day as well as at dusk and in the night ; they were the species that fed most voraciously on man. *A. maculatus* and *A. willmori* also occurred in dwellings, the latter in large numbers, and both bite readily at dusk and during the night. *A. fuliginosus* was ubiquitous and *A. maculipalpis* occurred in labourers' huts, but neither was observed to bite man except during the night.

Practically all the usual control measures were undertaken at one time or another. Drainage was impracticable in many areas but oiling was carried out from 1921–28. The mixture found most satisfactory was 75 per cent. crude oil, 20 per cent. kerosene and 5 per cent. castor oil. In October 1928, Paris green was substituted for oiling and was found to be more effective. At first a dilution of 1 per cent. Paris green in road dust (which contains a high percentage of sand in this locality) was applied at the rate of 1 oz. Paris green to every 100 sq. ft. of surface, but it was later found that considerably less could be used, especially in the season when *A. ludlowi* was prevalent. When the swamps had once been cleared, a dilution of 1 in 200 was sufficient in some cases to control breeding. The use of sand as a diluent instead of road dust gave better results over areas covered with reeds and jungle grass and also resulted in the killing of large numbers of Culicine larvae. Larvicidal fish were numerous in all marshes and streams, and were introduced into isolated ponds and borrow pits, but it is extremely doubtful whether they were of any value. Fumigation of permanent and temporary buildings was carried out at weekly intervals from 1928 and was found to be of great importance. For routine work a mixture of equal parts of sulphur and powdered waste tobacco leaves and stems was employed. Fumigation proved of great value even in the case of labourers' huts and sheds made of grass and bamboo. At the rate of ½ lb. to 1,000 cu. ft. space, the mixture, if burned quickly, was found to clear closed buildings of mosquitos in 15 minutes. A spray of 1 per cent. carbon tetrachloride, 2 per cent. creosote and 97 per cent. kerosene was most efficient where fumigation could not be used.

Macdonald (G.) & Chowdhury (K. L.). **Report on a Malaria Survey of the Tea Gardens in the Mariani Medical Association, Assam.**—*Rec. Malaria Surv. India*, ii, no. 1, pp. 111–156, 5 refs. Calcutta, March 1931.

An account is given of a malaria survey of 18 tea gardens in the Sibsagar District of Assam (about 350 ft. above sea level) carried out between 25th May and 5th July 1930. Thirteen species of Anophelines were found, all of which were noticed in a previous list [*R.A.E.*, B, xviii, 39]. *Anopheles minimus*, Theo., and *A. culicifacies*, Giles, are the most important carriers of malaria. *A. maculatus*, Theo., and *A. aconitus*, Dön., which are vectors in other parts of the world, may be ignored in this region as they are scarce at the time the transmission of the disease takes place. The chief types of breeding-places are discussed, together with the Anophelines found in them, and their bearing on the severity of malaria. The measures recommended include care in the selection of sites for new lines so as to avoid potential breeding-places of *A. minimus* and *A. culicifacies*; and the prevention of breeding of these species by allowing the dense growth of thick vegetation that naturally occurs in the watercourses and drains to remain (instead of being cleared as is usually done either with the idea of improving the drainage or as an anti-malaria measure), or by the regular application of Paris green at weekly intervals throughout the malaria season from May to October. In the second part of the paper, notes are given on individual estates, showing the incidence of malaria, the breeding-places of Anophelines and the anti-malarial measures recommended.

Barraud (P. J.). **Notes on some entomological Technique for the Malariologist.**—*Rec. Malaria Surv. India*, ii, no. 1, pp. 157–160. Calcutta, March 1931.

For sending specimens of Anopheline larvae through the post the author recommends the following procedure : The bottom of a specimen tube (1 in. by 2½–3 ins.) is filled to a depth of ½ in. with cotton wool soaked in formalin held in place by a tightly fitting disk of cork about ¼ in. thick. The cork becomes soaked with formalin, and any excess liquid is poured off. The larvae are transferred from water to the tube with a spoon or wide-mouthed pipette, and all the water is subsequently poured off or drawn off with a pipette, leaving the larvae stranded on the cork disk or on the sides of the tube. The tube is then tightly corked, wrapped in cotton-wool or soft paper and packed in a wooden box. The larvae are killed by the formalin vapour and remain attached to the tube so that there is little risk of their being shaken about. This method appears to be preferable to the more usual one of sending specimens in liquid preservative, for if even a small bubble of air is left in the liquid the larvae are subject to considerable shaking and consequent damage.

A fairly simple method is described for rearing large numbers of mosquitos, which does not require much time or attention. Gravid females are placed in a hurricane lamp globe, the upper end of which is covered with mosquito netting, on which are raisins and a strip of lint kept damp. A receptacle containing water is placed inside the lower end of the globe, and a few grass stems may be provided as resting places for the mosquitos. The globes should be kept in a dark place free from ants. If the temperature is very low, the globes may be kept in an incubator at about 20–22° C. [68–71·6° F.]. Some species, *e.g.*, *Anopheles pulcherrimus*, Theo., will not readily oviposit in confinement, but eggs may usually be obtained by transferring the female to a test tube and allowing it to fall from the tube on to the surface of water as suggested by P. G. Shute. Soon after the eggs have been laid, they are transferred by means of a camel-hair brush to a receptacle, preferably a glass petri dish 8–10 ins. in diameter, where they are floated within a hollow square of cork coated with paraffin wax to prevent their becoming stranded on the sides of the dish during evaporation of the water, as recommended by Macgregor [*R.A.E.*, B, xv, 227]. Some *Spirogyra* and a plant of grass with a certain amount of soil attached to the roots are added, and, as soon as the larvae hatch, some chopped flies are scattered over the surface of the water. The *Spirogyra* should be kept for some time previously in a basin and exposed to the sunshine, any living creatures being removed from time to time. The dishes containing the larvae should be kept in the sun for several hours during the day ; this causes bubbles of oxygen to form in the *Spirogyra* and so keeps the water aerated and prevents the formation of scum. The grass plant provides shade and shelter. The dishes are examined about midday, when cool water and more food material are added if necessary. About 4–5 p.m., they are covered with another dish or a sheet of glass to prevent other mosquitos from laying eggs on the water. On no account should the dishes be covered when exposed to the sun. A list is given of the species of Anophelines that have been reared in this way.

Further instances are given of the successful use of the method already described for transmitting living mosquitos through the post [xvii, 255].

Christophers (S. R.) & Barraud (P. J.). **The Eggs of Indian** *Anopheles*, **with Descriptions of the hitherto undescribed Eggs of a number of Species.**—*Rec. Malaria Surv. India*, ii, no. 1, pp. 161–192, 5 pls., 2 pp. refs. Calcutta, March 1931.

During October and December 1930, a study was made of the eggs of 23 species of Indian Anophelines. Previous work on this subject is briefly reviewed. The eggs were obtained by the method of rearing described in the previous paper, and examined when floating or when mounted on strips of moistened filter paper on slides. The structure of the egg of an Anopheline is discussed. Descriptions, with a key, are given of the eggs of 28 species of Indian *Anopheles*, including 7 of which the eggs were previously unknown, namely, *A. jamesi*, Theo., *A. jeyporiensis*, James, *A. moghulensis*, Christ., *A. pallidus*, Theo., *A.* (?) *philippinnesis*, Ludl., *A. ramsayi*, Covell, and *A. willmori*, James.

Christophers (S. R.), Sinton (J. A.) & Covell (G.). **How to do a Malaria Survey.**—*Health Bull.*, no. 14 (*Malaria Bur.*, no. 6), 2nd edn., 174 pp., 11 pls., 3 figs. Calcutta, Govt. India Central Pubn. Br., 1931. Price 1*s*.

This edition of a previous bulletin [*R.A.E.*, B, xvii, 84] has been enlarged and revised (as a result of experience gained in its use as an aid to teaching) with a view to making it a summary of the technique used in undertaking malaria surveys. The additional information includes a list of Indian species of *Anopheles*, with their distribution, usual breeding-places, and importance with regard to the transmission of malaria in India, methods for making permanent preparations of mosquito larvae and of infected guts, and a field method for the estimation of the amount of salinity of the water in mosquito breeding-places.

Chung (H. L.) & Lin (Y. Y.). **Collection of Mosquitoes in South China.**—*Lingnan Sci. J.*, vii (1929), pp. 401–407. Canton [1931].

An account is given of mosquito surveys, conducted in two malarious localities in the provinces of Kwangtung and Fukien respectively, during the summer of 1927, with a list of the species collected and brief recommendation for their control. Of the Anophelines found, *Anopheles hyrcanus*, Pall., *A. maculipalpis* var. *splendidus*, Koidz. (*indiensis*, Theo.) and *A. minimus*, Theo., occurred in both districts, and *A. maculatus*, Theo., in Kwangtung.

Martini (E.). **Das Bestäubungs-, besonders Schweinfurtergrün-Verfahren in der Malariabekämpfung.** [Dusting, especially with Paris Green, in Malaria Control.]—*Z. Desinfekt.*, xxiii, no. 4, pp. 151–166, 52 refs. Dresden, April 1931.

This is a survey of the use of dusts, especially Paris green, against Anopheline larvae, with a valuable bibliography.

OXNER (—). **Trois années d'expériences d'acclimatation des *Gambusia* sur la Côte d'Azur. Mésures antilarvaires dans la lutte générale contre les moustiques et instructions techniques sur l'emploi des poissons larvivores.**—20 pp. Nice, Soc. méd. Litt. méditerr., 1930. (Abstract in *Bull. mens. Off. int. Hyg. publ.*, xxiii, no. 6, pp. 1099–1100. Paris, June 1931.)

The history of the importation into Europe of *Gambusia* is reviewed, with notes on the conditions favourable to the life, transport and reproduction of these minnows ; and an account is given of the results of rearing and acclimatising them during three years in the South of France, where they have reproduced in quantities and mosquito larvae are not found in waters that they occupy.

For the liberation of *Gambusia*, it is possible either to release large numbers for immediate effect in small areas, preferably during the spring, or smaller numbers in order that they may increase during one season and become effective in the next. In the latter case, they should be liberated in early spring or better still in October. Every two years it is well to add a few pairs of a different origin to each reservoir of water so as to prevent the stock degenerating.

[KALMUIKOV (E. S.) & ZADUL'SKAYA (E. S.).] **Калмыков (Е. С.) и Задульская (Е. С.). Data on the comparative Phenology of** *Anopheles maculipennis* **Mg.** [*In Russian.*]—*Trop. Med. Vet.*, viii, no. 10, pp. 23–26. Moscow, December 1930. [Recd. May 1931.]

In continuation of previous work on the biology of *Anopheles maculipennis*, Mg., in the neighbourhood of peat bogs in the Moscow Government [*R.A.E.*, B, xviii, 79], the authors discuss in detail the ecological conditions of its breeding-places in the peat bogs and in a dry river bed 3 miles away, and show that owing to differences in the physical, chemical and biological characters of the various collections of water, the development of the larvae may vary in the different breeding-places in the same district. It is advisable, therefore, prior to applying a larvicide, to determine for each type of breeding-place the average dates at which the instars that are susceptible to the poison are present.

[MCHELIDZE (I. Z.).] **Мчелидзе (И. З.). The Control of** *Aëdes aegypti* **in Batum.** [*In Russian.*]—*Trop. Med. Vet.*, viii, no. 10, pp. 26–27. Moscow, December 1930. [Recd. May 1931.]

A brief account is given of the organisation in the town of Batum of investigations on the breeding-places of *Aëdes argenteus*, Poir. (*aegypti*, auct.) and of the control of this and other mosquitos, which included oiling of canals and of the water in tubs and other reservoirs, the introduction of *Gambusia*, and catching the mosquito larvae with nets. These measures resulted in a considerable decrease in the number of mosquitos.

SNIJDERS (E. P.), DINGER (J. E.) & SCHÜFFNER (W.). **On the Transmission of Dengue in Sumatra.**—*Amer. J. Trop. Med.*, xi, no. 3, pp. 171–197, 12 figs., 8 charts, 7 refs. Baltimore, Md., May 1931. **Over de overbrenging der Sumatraansche Dengue (2e Mededeeling).**—*Geneesk. Tijdschr. Ned.-Ind.*, lxxi, no. 4, pp. 345–353, 2 pls. Batavia, April 1931.

The first paper is a translation of one already noticed [*R.A.E.*, B, xix, 146] and of the second, which discusses further cases of transmission of Sumatran dengue by infected examples of *Aëdes argenteus*, Poir. (*aegypti*, auct.) and *A. albopictus*, Skuse, that had been sent to Holland. This disease appears to be identical with Philippine dengue [xiv, 124] and strongly resembles that in Australia [vii, 61]. It is probably the same as van de Scheer's fever [xix, 146].

SIMMONS (J. S.), ST. JOHN (J. H.), HOLT (R. L.) & REYNOLDS (F. H. K.). **The possible Transfer of Dengue Virus from infected to normal Mosquitoes during Copulation.**—*Amer. J. Trop. Med.*, xi, no. 3, pp. 199–216, 8 charts, 4 refs. Baltimore, Md., May 1931.

An account is given of experiments carried out in the Philippines with *Aëdes argenteus*, Poir. (*aegypti*, auct.), which indicate that if it is possible for the virus of dengue to be transmitted from mosquito to mosquito by copulation, as the results of one experiment would suggest, such transmission is effected with great difficulty and probably occurs so rarely in nature that it may be regarded as an improbable means of perpetuating the virus.

ILLINGWORTH (J. F.). **The use of Arsenic in Mosquito Control.**—*Proc. Hawaii. Ent. Soc.*, vii, no. 3, p. 414. Honolulu, April 1931,

In greenhouses in Hawaii, where tender pineapple roots were suspended in water cultures, larvae of *Aëdes argenteus*, Poir. (*aegypti*, auct.) were found in the water. Paris green at the rate of one part to about one million parts of water killed the larvae, but injured the pineapple roots. Lead arsenate, which is only slightly soluble, when used in the same strength gave excellent results.

ILLINGWORTH (J. F.). **Pineapple Cannery Waste and its Insect Problems.**—*Proc. Hawaii. Ent. Soc.*, vii, no. 3, pp. 462–465. Honolulu, April 1931.

Refuse from pineapple canneries in Hawaii frequently offers an ideal breeding-ground for insects. A case is recorded in which house-flies [*Musca*] bred in such numbers in the fermented scum formed in pools of wash water containing fruit fibre, etc., that the adjacent cannery was almost compelled to close. After many attempts to control the breeding, a poison was made of 50 lb. caustic soda and 270 lb. white arsenic in 100 U.S. gals. water ; as soon as the arsenic became soluble the liquid was run very slowly into the flume carrying the waste waters from the cannery. A few days later breeding ceased in the pools. Nitidulid beetles, which are attracted to over ripe fruit, have also appeared in such numbers that large canneries have installed special machinery for drying the refuse from the fruit, which is then used as food for stock.

DE BOISSEZON (P.). **Contribution à l'étude de la biologie et de l'histophysiologie de** *Culex pipiens* **L.**—*Arch. Zool. exp. gén.*, lxx, no. 4, pp. 281–431, 4 pls., 17 figs., 10 pp. refs. Paris, 24th December 1930.

This is an account of the author's investigations, with references to those of others, on the biology and histophysiology of *Culex pipiens*, L. [*cf. R.A.E.*, B, xviii, 9, 87, 94, 119, 211]. Chapters are devoted to breeding and biology, digestion and digestive apparatus, both of larva and adult, digestion of blood, fat-body, and flagellate parasites of the adult.

WALCH (E. W.), VAN BREEMEN (M. L.) & REYNTJES (E. J.). **The Sanitation of the Saltwater Fishponds of Batavia (a Contribution towards the "hygienic" Exploitation of the Bandeng-Ponds).**—*Meded. Dienst. Volksgezond. Ned.-Ind.*, Foreign Edn., xix, pt. 3, pp. 400–430, 8 pls., 4 plans. Batavia, 1930. [Recd. 1931.]

This paper describes an experiment in draining salt-water fishponds at Batavia by a method that destroys the algae, but allows the fish to gather in certain deeper portions [*R.A.E.*, B, xviii, 185]. It was found that even with the slight tides of only about three feet obtaining at Batavia this method was successful economically. Within two and a half weeks of the first general draining, Anopheline larvae could no longer be found in the ponds. Water free from floating green algae may become breeding-places unless the larvicidal fish, *Haplochilus panchax*, is present in sufficient numbers. A method of preventing *H. panchax* from destroying the other fish for which the ponds are maintained was worked out.

SCHUURMAN (C. J.) & SCHUURMAN-TEN BOKKEL HUININK (A. M.). **A Study of the Epidemiology of Plague in West-Java, specially with a View to a possible Share of the Musk Shrew.**—*Meded. Dienst. Volksgezond. Ned.-Ind.*, Foreign Edn., xix, pt. 3, pp. 431–546, 5 pls., 14 tables, 4 maps, 59 refs. Batavia, 1930. [Recd. 1931.]

This is a detailed account of a study of the factors determining the course of plague epizootics in West Java, in the course of which small mammals were trapped in 87 villages or village-groups. In general only the musk shrew (*Crocidura coerulea*) and house rats were caught in considerable numbers. Both harboured *Xenopsylla cheopis*, Roths., which was shown to breed in their nests and pass from one to another, but the rats appeared to be outnumbered by the shrews and almost everywhere the *cheopis* index of the latter was much higher than that of the former. The index decreased from October 1929 to May 1930, especially on the shrews. There was a distinct correlation between the *cheopis* indices of the rat and shrew and the monthly numbers of plague cases in the Koeningan district, and the *cheopis* index of the shrew showed an accurate parallel to the plague mortality rate in the whole area investigated. *X. astia*, Roths., is equally distributed in small numbers in all villages of Cheribon, but its index figures are always low. A considerable amount of evidence was obtained of the importance of the shrew in relation to the spread of plague. Experiments with marked individuals show that it migrates from village to village, and infection experiments show that it can harbour plague infection for at least 17 days and that fleas on it can remain infective for at least 4 days.

Bauvallet (H.). **Index Aëdinae à Cotonou (Dahomey).**—*Bull. Soc. Path. exot.*, xxiv, no. 4, pp. 292–295. Paris, 1931.

The total number of breeding-places of *Aëdes argenteus*, Poir., *A. luteocephalus*, Newst., *A. stokesi*, Evans, and *Eretmopodites chrysogaster*, Graham, found in Cotonou, Dahomey, in each month during 1929 and 1930 are tabulated, together with the "index," *i.e.*, the percentage of breeding-places to habitations [*cf. R.A.E.*, B, xvi, 213]. The average index was 0·70 per cent. for 1929 and 0·59 for 1930, the average indices for the previous years being 1·17 in 1925, 2·16 in 1926 and 2·74 in 1927. The anti-mosquito campaign has resulted in the almost entire freedom of Cotonou from yellow fever, although localities in the vicinity, under similar meteorological conditions, have been seriously affected.

Cardamatis (J. P.). **Etude préliminaire sur les phlébotomes en Grèce.**—*Bull. Soc. Path. exot.*, xxiv, no. 4, pp. 287–292, 1 fig., 3 refs. Paris, 1931.

The sandflies found in Greece are *Phlebotomus papatasii*, Scop., *P. minutus*, Rond., *P. sergenti*, Parrot, which is sometimes even more abundant than *P. papatasii* [*cf. R.A. E.*, B, xvii, 166], *P. perniciosus*, Newst., of which one individual was reared in the laboratory, and an unidentified species allied to *P. sergenti*.

Galliard (H.) & Nitzulescu (V.). **Contribution à l'etude des phlébotomes du Gabon.** *Phlebotomus sanneri* **n. sp.**—*Ann. Paras. hum. comp.*, ix, no. 3, pp. 233–246, 10 figs., 16 refs. Paris, May 1931.

Four sandflies collected in the western part of Gabon, French Equatorial Africa, were a male of *Phlebotomus africanus*, Newst., from which the description of the buccal armature of this species is completed, and three females of *Phlebotomus sanneri*, sp. n., which is described. The latter is the form recorded from the Belgian Congo by Parrot as *P. minutus* var. *antennatus*, Newst. [*R.A.E.*, B, xviii, 235].

Nitzulescu (V.). **Deuxième contribution à l'étude des phlébotomes du groupe** *minutus*. *Phlebotomus fallax* **Parrot, 1931.**—*Ann. Paras. hum. comp.*, ix, no. 3, pp. 256–260, 4 figs., 4 refs. Paris, May 1931.

From a study of its morphological characters, the author inclines to the view that *Phlebotomus fallax*, Parrot [*R.A.E.*, B, ix, 170] should be regarded as a variety of *P. minutus*, Rond., but considers that this cannot definitely be determined until the female has been described.

Nitzulescu (V.). **A propos du** *Phlebotomus chinensis*.—*Ann. Paras. hum. comp.*, ix, no. 3, pp. 261–265, 3 pls., 7 refs. Paris, May 1931.

The author discusses the characters distinguishing the different forms of *Phlebotomus chinensis*, Newst. He considers that the typical form should be that described from China [*R.A.E.*, B, xviii, 245]. The forms from Bucarest [xviii, 13], Persia [xix, 62] and Syria [xvii, 187] are identical with those [from Bokhara] described as *P. major*

var. *longiductus*, Parrot [xvii, 17] and now become *P. chinensis* var. *longiductus*, Parrot [xix, 161]. The forms from Palestine [xvii, 187] and Jugoslavia [xviii, 13; xix, 159] are *P. chinensis* var. *simici*, Nitzu. [xix, 161].

NITZULESCU (V.). **Sur la présence en Yougoslavie du *Phlebotomus perniciosus* var. *tobbi* Adler, Theodor et Lourie, 1930.**—*Ann. Paras. hum. comp.*, ix, no. 3, pp. 266–270, 4 figs., 5 refs. Paris, May 1931.

The form of *Phlebotomus perniciosus*, Newst., found by Simić in Jugoslavia [*R.A.E.*, B, xix, 159] is identified as *P. perniciosus* var. *tobbi*, Adl., Thdr. & Lourie [xix, 62].

NITZULESCU (V.). **Essai de classification des phlébotomes.**—*Ann. Paras. hum. comp.*, ix, no. 3, pp. 271–275. Paris, May 1931.

The author proposes a system of classification for the species of the genus *Phlebotomus* based chiefly on the presence or absence of the buccal armature. Five subgenera, *Sintonius, Brumptius, Larroussius, Phlebotomus* and *Adlerius* are erected, the type and principal additional species contained in each being given. *Phlebotomus wenyoni*, Adl., Thdr. & Lourie [*R.A.E.*, B, xix, 62] is considered to be a variety of *P. major*, Ann.

PHILIP (C. B.). **Découverte en Afrique occidentale d'*Hunterellus hookeri* Howard, parasite des Ixodidés.**—*Ann. Paras. hum. comp.*, ix, no. 3, p. 276, 2 refs. Paris, May 1931.

Hunterellus hookeri, How., is recorded as parasitising more than 90 per cent. of the engorged nymphs of *Rhipicephalus sanguineus*, Latr., found on dogs near Lagos, Nigeria, in April 1929. A large number of adult parasites were also taken among the hairs of the same dogs during April, May and June.

[KHODUKIN (N. I.) & SOFIEV (M. S.).] **Ходукин (Н. И.) и Софиев (М. С.). A Revision of the Sandflies of Central Asia.** [*In Russian.*] —*Meditz. Muisl' Uzbekist. i Turkmenist.*, v, no. 4, pp. 50–55, 9 figs. Tashkent, January 1931.

As a result of further studies [*cf*. *R.A.E.*, B, xix, 55], the authors state that the species of *Phlebotomus* occurring in Central Asia are *P. papatasii*, Scop., *P. sergenti*, Parrot, *P. sergenti* var. *mongolensis*, Sinton, *P. caucasicus*, Marz., *P. grekovi*, Khoduk., *P. minutus*, Rond., *P. major*, Ann., *P. chinensis*, Newst. (of which *P. major* var. *longiductus*, Parrot, is considered a synonym), and *P. borowskii*, sp. n., and *P. stalinabadi*, sp. n., both of which are described from females only.

P. selectus, Khoduk. [*loc. cit.*] has now been found to be identical with *P. caucasicus* [xviii, 114]. The authors state that *P. perniciosus*, Newst., has not been found in Central Asia and that records of it are due to misidentification [*cf.* xvii, 9; xviii, 41, 128]. They do not consider *P. sergenti* var. *mongolensis* to be distinguishable from var. *alexandri*, Sinton [xvii, 30; xviii, 6, 9]. The record of *P. africanus*, Newst. [xix, 55] has not been confirmed and is considered doubtful.

With regard to *P. minutus* var. *sogdianus*, Parrot [xvii, 17; xviii, 7], as the only description available is that of the male, and the male genitalia are similar to those of other species of the *minutus* group, the authors consider that this form cannot be recognised, though *P. grekovi* or *P. stalinabadi* may be identical with it.

A description is given of the female of an unidentified species of the *minutus* group, two individuals of which were found near Stalinabad in a cave where numerous larvae of the tick, *Ornithodorus papillipes*, Birula, were present.

[Danilov (B. A.).] **Данилов (Б. А.). The Rôle of certain small Ponds of the former Old Tashkent in the Epidemiology of Malaria.** [*In Russian.*]—*Meditz. Muisl' Uzbekist. i Turkmenist.*, v, no. 4, pp. 56–67, 2 figs., 22 refs. Tashkent, January 1931.

Investigations in and near the town of Old Tashkent (Eastern Uzbekistan) in 1925–28 showed that numerous small ponds that contain drinking water and form part of the local irrigation system are the chief breeding-places of mosquito larvae. From 16 to 30 per cent. of the ponds were infested, mainly with Anophelines, of which *Anopheles sacharovi*, Favr, was much the most numerous. *A. hyrcanus*, Pall., *A. superpictus*, Grassi, and *A. bifurcatus*, L., occurred in a few ponds only. These ponds, most of which have a surface area of between 500 and 1,600 sq. ft. and are 3–6 ft. deep, are filled from the irrigation ditches, usually in the second half of February. As a rule the water is constantly running through them from March till the end of August, when the supply from the ditches stops and the water in the ponds becomes stagnant.

The temperature of the water at various depths, and the fauna and vegetation occurring in the ponds are briefly discussed. Larvae of *A. sacharovi* appeared in them 37–50 days later than in swamps formed by neglected irrigation ditches near the town. The ponds in the summer resorts on the outskirts of the town, which often adjoin other water reservoirs and are smaller than those in the centre, were infested more readily than the latter. The larvae chiefly occurred in ponds the banks of which were covered with vegetation partly submerged in water, and where *Spirogyra* and *Zygnema* were present, but they were also found in ponds in which there were no macrophytes, and in those with cement, brick or wooden walls, provided that a suitable vegetation was present. Periodical emptying and cleaning of the ponds in the summer and removal of the vegetation is recommended.

Christophers (S. R.) & Puri (I. M.). **Notes on some Anopheline Mosquitoes collected in Sierra Leone including differentiation of *Anopheles dthali* Patton (Mediterranean) as a distinct Species from *Anopheles rhodesiensis* Theo. (Ethiopian).**—*Ind. J. Med. Res.*, xviii, no. 4, pp. 1133–1166, 3 pls., 3 figs., 5 pp. refs. Calcutta, April 1931.

A number of Anopheline mosquitos were collected in Sierra Leone in September 1928, and the results of an examination of this material are reported in this paper. The following is taken largely from the authors' summary. The species of *Anopheles* from southern Palestine, Sinai, Upper Mesopotamia, Aden, Muscat, Baluchistan and the North-west Frontier Province (India), hitherto recorded as *A. rhodesiensis*,

Theo., is actually *A. dthali*, Patton, *A. rhodesiensis* being an Ethiopian species. The characters distinguishing the two species are given, and the distribution of each is dealt with. A description of *A. rhodesiensis* is given, including the hypopygial and pharyngeal characters of the adult and the pleural hairs of the larvae, which have not hitherto been described, all previous descriptions relating to *A. dthali*. The specimens of *A. theileri*, Edw., from Sierra Leone do not conform to any of the varietal forms already described [*R.A.E.*, B, xviii, 43]. The hypopygial and pharyngeal characters of this species are given. The pharyngeal characters of *A. gambiae*, Giles, are described. The characters of various species allied to *A. marshalli*, Theo., are shown in a table; *A. marshalli* var. *freetownensis*, Evans, is regarded as a distinct species. Notes on *A. smithi*, Theo., include the pharyngeal and hypopygial characters. A bibliography of each of the species dealt with is given, and descriptions of the full-grown larvae of *A. theileri*, *A. gambiae* and *A. smithi*, including in each case a description of the pleural hairs, are appended.

Jolly (G. G.), Fenn (V. W.) & Dorai (R.). **Rat-flea Survey of Rangoon. Part I. The Port Area. Period from 5th January 1928 to 4th January 1929.**—*Ind. J. Med. Res.*, xviii, no. 4, pp. 1231–1244, 1 plan, 3 graphs, 4 refs. Calcutta, April 1931.

During a survey of the Rangoon Port area, which was made from January 1928 to January 1929, 7,293 rats were examined and 18,884 fleas collected. *Mus concolor* and *Nesokia bengalensis*, the commonest rats, were found in nearly equal proportions and together formed 62 per cent. of the rats examined. *M.* (*Rattus*) *rattus* formed only 8·83 per cent. of the total. For all species of rats, the flea index was 2·59, the index for *Xenopsylla astia*, Roths, being 2·45 and for *X. cheopis*, Roths., 0·14. There was a pronounced seasonal fluctuation in the numbers of *X. astia*, whereas the numbers of *X. cheopis* remained at a relatively low level throughout the year. The survey, while demonstrating a low prevalence of *X. cheopis*, shows the relative preference of this flea for indoor rats as opposed to outdoor ones.

Gill (C. A.) & Lal (R. B.). **The Epidemiology of Cholera, with special Reference to Transmission. A preliminary Report.**—*Ind. J. Med. Res.*, xviii, no. 4, pp. 1255–1297, 3 charts, 1 map, 17 refs. Calcutta, April 1931.

The history of the incidence of cholera in the Punjab from 1924 to 1929 is reviewed in some detail, and it is concluded that whereas "explosive" epidemics are usually dependent on the recent and massive infection of water, it is difficult, although not impossible, to account for a protracted epidemic on this basis. In order to explain epidemiological facts, the hypothesis was formulated that house-flies do not merely carry the cholera vibrio mechanically and so accidentally pollute human food and drink, but that the vibrio undergoes a cycle of development in their tissues and is afterwards transmitted with the ease and certainty associated with true biological transmission. "Explosive" epidemics are distinctly rare in the Punjab (about 2·5 per cent. of all outbreaks) and it therefore appears that water does not play a predominant part in the spread of cholera in this Province.

Details are given of laboratory experiments with flies that were caught in latrines and have not yet been identified, undertaken to test this hypothesis. The results show that the vibrios are capable of surviving in the fly for a period of at least five days ; that they disappear from its body after about 24 hours but re-appear on or about the fifth day, at which time the fly is capable of infecting food by its faeces ; and that although infection of milk by means of the proboscis can take place up to 24 hours, it has not yet been proved that infection can take place in this way on or after the fifth day. Although incomplete, these observations suggest that possibly one phase of the life-cycle of the vibrio is passed in the body of the fly, and that this insect may play a more important part in the transmission of cholera than has hitherto been suspected.

SHORTT (H. E.), SMITH (R. O. A.), SWAMINATH (C. S.) & KRISHNAN (K. V.). **Transmission of Indian Kala-azar by the Bite of** *Phlebotomus argentipes*.—*Ind. J. Med. Res.*, xviii, no. 4, pp. 1373–1375. Calcutta, April 1931.

The first case is recorded of the successful transmission of kala-azar to a Chinese hamster [*Cricetulus*] by the bites of infected individuals of *Phlebotomus argentipes*, Ann. & Brun. A total of 144 sandflies were used of which 38 were known to be infected. The only detail in which this experiment differed from previous ones [*cf. R.A.E.*, B, xvii, 29, etc.] was in the somewhat longer period elapsing between its commencement and termination by post-mortem examination of the animal. In this case the period was 511 days, whereas the longest period in any previous similar experiment was 435. This point is not believed to be of importance, since the hamster showed no macroscopic enlargement of the spleen, a fact indicating the probability of a comparatively recent infection, *i.e.*, one occurring late in the series of feeding experiments.

The fact that only one out of 42 hamsters used in similar experiments has become infected indicates that the infection rate by the bite of *P. argentipes* may be low. This would be a possible explanation of the slow spread of kala-azar in normal inter-epidemic periods and of its more rapid dissemination during an epidemic, when the number of cases results in a high percentage of infected flies. It is also possible that the more rapid succession of passages of the parasite from man to fly and back during an epidemic would increase its virulence. For this reason it is suggested that failure to obtain successful transmission in previous experiments was due to the fact that they were only undertaken on a large scale when the recent kala-azar epidemic was on the wane and the virulence of *Leishmania donovani* was already decreasing.

NAPIER (L. E.). **Feeding Habits of Sandflies of the** ***minutus*** **Group.**—*Ind. J. Med. Res.*, xviii, no. 4, pp. 1377–1381, 7 refs. Calcutta, April 1931.

Commenting on a criticism by Shortt [*R.A.E.*, B, xix, 132] of a previous paper [xviii, 268], the author points out that from comparison with specimens identified by Sinton, the sandflies of the group of *Phlebotomus minutus*, Rond., found to feed on human blood in Bengal were almost certainly *P. babu*, Ann., or *P. babu* var. *niger*, Ann. In subsequent observations, three sandflies of the group of *P. minutus*,

taken in a cowshed (two of which were identified by Sinton as *P. babu* var. *niger* and one as *P. shortti*, Adl. & Thdr.), were examined by means of the precipitin test. All three were found to contain bovine blood and two human blood.

PATANÈ (C.). **La fauna murina di Bengasi ed i rispettivi pulicidi parassiti. Confronti col comportamento stagionale delle locali manifestazioni epidemiche di peste.** [Rats and their Fleas in Benghasi. A Comparison of their seasonal Prevalence and local Epidemics of Plague.]—*Arch. ital. Sci. med. colon.*, xi, no. 9, pp. 544–566. Tripoli, September 1930. (With a Summary in English.) (Abstract in *Trop. Dis. Bull.*, xxviii, no. 7, p. 532. London, July 1931.)

Of 2,700 rats examined during 1920–23, 56 per cent. are said to be *Mus rattus alexandrinus* and 44 per cent. *M. rattus*, though these figures include a considerable proportion entered as classifiable with difficulty. The rat population is said to be higher in the spring and summer. The average number of fleas to a rat in 1922 was 3·5 and in 1923 4·2. *Xenopsylla cheopis*, Roths., and *Leptopsylla segnis*, Schönh. (*Ctenopsylla musculi*, Dug.) constituted 97 per cent. of the total, the former slightly predominating; the others were *Ceratophyllus fasciatus*, Bosc, and *Ctenocephalides* (*Ctenocephalus*) *felis*, Bch., with occasional individuals of *C.* (*C.*) *canis*, Curt., and *Pulex irritans*, L. The returns of deaths from plague for the years 1914–22 show the largest numbers in April-July, but except in 1917 and 1918, plague was not very prevalent.

SIKES (E. K.). **Notes on breeding Fleas, with Reference to Humidity and Feeding.**—*Parasitology*, xxiii, no. 2, pp. 243–249, 1 chart, 4 refs. Cambridge, May 1931.

In the course of investigations on the feeding of flea larvae, it was found that the humidity of the air in the breeding vessel was important and that the optimum atmospheric humidity varied according to the kind of food provided. In this paper an account is given of experiments made to determine the hygroscopic properties of certain food substances supplied to flea larvae.

The following is largely taken from the author's summary: In experiments with *Ceratophyllus wickhami*, Baker, using dried blood, albumen (blood) and material from the bottom of a squirrel's nest, it was found that the larvae require about 15–28 per cent. water in their food. When newly hatched larvae were fed on different substances at varying humidities and a constant temperature, the largest numbers were reared at a relative humidity of 80 per cent., which appears to be the most favourable for general use with any food. When fed on dried blood, the larvae require a relative humidity of 80–90 per cent., but when albumen is used they can survive at lower humidities. Dried blood is a convenient food, and may be used with or without a mixing medium, such as sand. Albumen is a more simple food on which a few larvae will survive, but at lower humidities than when dried blood is employed. Flea larvae will eat a number of other foods, including squirrel faeces, ground-up cockroach and dead adult fleas, but these do not provide a complete diet. Dried blood from rabbit or man seems to be as satisfactory for feeding the larvae as blood from the host of the adult fleas.

Matheson (R.). **Note on the Tick** *Ornithodorus talaje* **(Guér.-Mên.).**—*Parasitology*, xxiii, no. 2, p. 270. Cambridge, May 1931.

A few individuals of *Ornithodorus talaje*, Guér., which has hitherto been recorded only from the extreme southern parts of the United States and in subtropical and tropical countries, have been taken on the walls of a house in western New York in summer and in mid-winter, showing that although this tick normally occurs in warm climates, it can maintain itself in a heated house in a northern one.

Lewis (E. A.). **Observations on Ticks and Tick-borne Diseases.**—*Bull. Dept. Agric. Kenya*, no. 2 of 1931, 15 pp., 6 figs. Nairobi, 1931.

A brief review is given of the ticks occurring in Kenya Colony and the diseases they transmit, together with general notes on their structure, life-history and habits. The Argasids comprise *Argas persicus*, Oken, the vector of spirochaetosis of fowls and other birds, a disease that has not yet been recorded from Kenya; *Ornithodorus moubata*, Murr., which transmits relapsing fever in man; and *O. savignyi*, Aud., which transmits relapsing fever in man and also occurs on a number of domestic animals.

Of the 35 species of Ixodids recorded, a certain number are known to be capable of transmitting disease. *Rhipicephalus appendiculatus*, Neum. (common brown tick) is the chief vector of African Coast fever [caused by *Theileria parva*] and also transmits *Piroplasma* (*Babesia*) *bigeminum*, *Theileria mutans* and probably anaplasmosis to cattle, and the virus of Nairobi sheep disease (gastro-enteritis) to sheep. *R. capensis*, Koch (Cape brown tick), *R. simus*, Koch (black-pitted tick) and *R. evertsi*, Neum. (red-legged tick) also transmit African Coast fever, and the last-named is concerned in the transmission of *Spirochaeta* (*Treponema*) *theileri* and piroplasmosis or biliary fever [*Nuttallia equi*] to horses, and *Theileria mutans* and anaplasmosis to cattle. *R. simus* is reported to have transmitted anaplasmosis experimentally. *Haemaphysalis leachi*, Aud. (dog tick) is the chief vector of malignant jaundice or tick fever [*Piroplasma canis*] in dogs, although this disease is also transmitted by *R. sanguineus*, Latr. (brown dog tick). *Boophilus annulatus decoloratus*, Koch (blue tick), which is very common throughout Kenya, transmits *P. bigeminum*, *S. theileri* and anaplasmosis to cattle. *Amblyomma hebraeum*, Koch (bont tick), which has only been taken in Kenya on two occasions [*cf. R.A.E.*, B, xviii, 220], and *A. variegatum*, F., which is common, are vectors of heartwater of cattle, sheep and goats. *Ixodes pilosus*, Koch, has been collected in Kenya on many occasions, but sheep paralysis has not been recorded there.

[*Haemaphysalis bispinosa*, **Neum., on Cattle in Fiji.**]—*Agric. J. Fiji*, iv, no. 1, pp. 1–2. Suva, 1931.

Haemaphysalis bispinosa, Neum., has been found for the first time on cattle in Fiji. This tick is not a vector of disease, but causes animals to lose condition.

Shelmire (B.) & Dove (W. E.). **The Tropical Rat Mite, *Liponyssus bacoti* Hirst, 1914, the Cause of a Skin Eruption of Man, and a possible Vector of Endemic Typhus Fever.**—*J. Amer. Med. Assoc.*, xcvi, pp. 579–584, 5 figs., 5 refs. Chicago, Ill., February 1931.

The authors record numerous cases of a skin eruption in man in northern Texas caused by the bites of *Liponyssus bacoti*, Hirst (tropical rat mite) [*cf. R.A.E.*, B, xii, 3], which appears to be well established in northern and eastern parts of the State. The mites were found in theatres, clinics, shops and private dwellings. The types of eruption are discussed.

When the female mites have engorged on rats they may remain in the hair for several hours, but usually they shelter in cracks, crevices and other protected places, preferably in the dark where there is no moisture. In such situations, after a single blood meal, they may deposit 3–8 eggs, which hatch in about 4–6 days. If the young mites are unable to find a suitable host within 12 days, they die of starvation. Thus, if all rats are destroyed, a period of 18 days must elapse before all the mites die of starvation. It is possible that the starvation of the nymphal stages of the mites may require slightly longer periods. The female mite is capable of living 10 days without feeding. The newly hatched mites feed on rats or mice for about two days after which they drop from their host and do not re-attach themselves until after moulting. There are apparently 4–5 feedings and 3–4 moults before they attain maturity. On man a mite may take a blood meal from several different places. This may be attributed to the disturbance of the mite or to the fact that man is an abnormal host.

Brill's disease first occurred in Texas at the time when "rat mite dermatitis" made its appearance, and the possibility that *L. bacoti* is the vector is suggested. Cases of Brill's disease occurring in Texas are discussed. *L. bacoti* was collected from rats in four localities where 11 proved and 125 suspected cases of Brill's disease occurred, and a history of "insect bites" previous to the onset of disease in one case supports the theory of an Arthropod vector.

Foley (H.). **Moeurs et médecine des Touareg de l'Ahaggar.**—*Arch. Inst. Pasteur Algérie*, viii, no. 2, pp. 167–287, 39 pls., 10 figs., 1 map, 16 refs. Algiers, 1930. [Recd. 1931.]

This paper includes information already noticed [*cf. R.A.E.*, B, xvii, 82, 146; xix, 11] on the blood-sucking Arthropods collected in the Algerian Sahara in the course of a scientific mission undertaken from 16th February to 14th May 1928.

Jack (R. W.). **Report of the Chief Entomologist for the Year 1930.**—*Rep. Secy. Dept. Agric. S. Rhodesia 1930*, pp. 65–73. Salisbury, 1931.

The present situation with regard to tsetse-fly in Southern Rhodesia and the control work carried out during the year are reviewed in detail. The tendency of *Glossina morsitans*, Westw., to spread towards its former limits has continued. No areas appear to have been vacated by it, except where measures for its reduction have been undertaken, and records of further spread have been obtained in several localities. The results likely to be obtained from the game reduction measures

recently initiated [*cf. R.A.E.*, B, xviii, 217] cannot yet be forecast, but in one area, where operations were begun in 1924, the situation has undoubtedly improved. Measures in the Lomagundi area [*loc. cit.*] have had a market effect on the fly population, and appreciable retrogression of the limits of the definite fly area is apparent, although some further cases of trypanosomiasis in cattle have occurred during the year. In the Gatooma sub-district improvement is indicated, but it is clear that considerable progress will be necessary before farms in this district lie outside the range of wandering flies from the definitely infested area.

Experiments have been carried out with various traps, including the type used against *G. pallidipes*, Aust., in Zululand [*R.A.E.*, B, xix, 78], but further work is necessary before any statement can be made as to whether any of them will be of practical value in the control of *G. morsitans*.

A heavy infestation of *Ornithodorus moubata*, Murr., occurred in pigsties in one district in April and May. The ticks were controlled by burning piles of brushwood on both sides of the 9-inch walls. Burning on only one side or spraying with kerosene emulsion failed to eradicate them.

Muscids caused considerable annoyance to cattle by feeding on the exudations from sores and wounds and from the bites of true blood-sucking flies. The species concerned were chiefly *Musca pumila*, Macq., *M. interrupta*, Wlk., *M. crassirostris*, Stein, and *M. sorbens*, Wied., which breed in fresh cow dung around cattle kraals. A bait of sweetened sodium arsenite (1 per cent. solution) gave negative results against these flies, but is effective against the house flies, *M. vicina*, Macq., *M. nebulo*, F., and *M. xanthomelas*, Wied., especially in the wet season.

UICHANCO (L. B.). **Coal Tar-Kerosene Emulsion and its Uses as an Insecticide.**—*Philipp. Agric.*, xix, no. 8, pp. 501–505, 4 refs. Laguna, P.I., January 1931.

In the course of this paper, the bulk of which has been noticed elsewhere [*R.A.E.*, A, xix, 468], M. L. Roxas reports successful control of myiasis in cattle, etc., caused by *Booponus intonsus*, Aldr., by removing the maggots from the hoofs, which are then immersed in an emulsion consisting of 5 lb. laundry soap, 5 gals. coal-tar (without creosote), 3 gals. kerosene and 4 gals water, diluted at the rate of 1 : 5.

It is stated that the screw worm infesting cattle in the Philippines which was erroneously identified as *Chrysomyia megacephala*, F. (*Compsomyia dux*, Esch.) [*R.A.E.*, B, xi, 92] has now been determined as *C. bezziana*, Villen.

MOUTIA (A.). [**Insect Pests in Mauritius in 1929.**]—*Ann. Rep. Dept. Agric. Mauritius 1929*, pp. 4–6. Port Louis, 1931.

In addition to the flies already recorded as injurious to domestic animals in Mauritius [*R.A.E.*, B, xviii, 242], *Oestrus ovis*, L., has been observed on several occasions causing myiasis [in sheep].

BEVAN (L. E. W.). **Myiasis.**—*Rep. Vet. Res. S. Rhodesia 1930*, pp. 10–11. Salisbury, 1931.

Myiasis of cattle, caused by the larvae of *Chrysomyia bezziana*, Villen., is very prevalent in some parts of Southern Rhodesia at certain seasons

and causes serious losses. In addition to the mortality that occurs, there is the loss of time and labour spent in dressing the wounds, which frequently become re-infested and require months of treatment before a cure is effected. With a view to discovering a more effective method of dealing with this problem, the bacterial flora of the wounds was studied and a culture was obtained that produced gases giving the characteristic smell encountered in cases of myiasis. The culture contained innumerable bacteria, but though the one responsible for the gas-formation in the wounds could not be isolated, it was reproduced by sub-culture. A vaccine was prepared from this culture that has given satisfactory results in preliminary tests. A few days after treatment, the odour became less, the maggots dropped out and the wound began to heal rapidly. The absence of odour also reduced the danger of re-infection. Of 22 reports on the use of this vaccine, 18 were favourable.

Cuillé (J.), Darraspen (E.) & Chelle (P.). **Contribution à l'étude des piroplasmoses du mouton. Premières observations de babésiellose en France.**—*Rev. gén. Méd. vét.*, xxxix, pp. 65–83. Toulouse, 15th January 1930. (Abstract in *Bull. Inst. Pasteur*, xxix, no. 11, p. 550. Paris, 15th June 1931.)

Piroplasmosis of sheep has been known in France since 1899, but the causal organism, *Babesiella ovis*, had not previously been recognised. It is here recorded in sheep on which the probable vector, *Rhipicephalus bursa*, C. & F. [*cf. R.A.E.*, B, ix, 116] has been found.

Regendanz (P.) & Reichenow (E.). **Ueber Zeckengift und Zeckenparalyse.** [Tick Poison and Tick Paralysis.]—*Arch. Schiffs- u. Tropenhyg.*, xxxv, no. 5, pp. 255–273, 3 figs., 10 refs. Leipzig, May 1931.

Records from various parts of the world of tick paralysis in man and animals are briefly reviewed, and an account is given of experiments in which injections of the eggs of *Rhipicephalus sanguineus*, Latr., or ovaries of this tick just before oviposition gave rise in dogs to symptoms identical with those of tick paralysis. Similar results were obtained with rabbits, guineapigs, rats, mice, and canaries. As moderate numbers (250–500) of eggs of *R. sanguineus* had previously failed to produce the symptoms in dogs, much larger numbers were used for the injections. It was evident that the poison concerned is identical with that causing tick paralysis and is formed especially in the process of egg-development, as the larvae and unfed adults did not contain it in detectable quantities. Its properties are described and compared with those of the poisons of other Arachnoids. The injection of small doses did not confer immunity.

An account is also given of the bionomics and anatomy of *R. sanguineus*.

Hakki (I.). **Les moustiques de Turquie et étude expérimentale sur quelques méthodes employées dans la lutte contre les larves d'anophèles.**—*Arch. Schiffs- u. Tropenhyg.*, xxxv, no. 5. pp. 303–309. Leipzig, May 1931.

The author gives a revised list of mosquitos in Turkey as a result of observations since 1926 [*R.A.E.*, B, xv, 80]. The Anophelines now

recorded are *Anopheles maculipennis*, Mg., *A. sacharovi*, Favr (*elutus*, Edw.), *A. superpictus*, Grassi, *A. hyrcanus*, Pall., *A. hyrcanus* var. *pseudopictus*, Grassi, *A. bifurcatus*, L., *A. algeriensis*, Theo., and *A. plumbeus*, Steph. From experiments with various oils and larvicides it is concluded that Paris green satisfies all the conditions required for practical work. It should contain about 55 per cent. of arsenic trioxide and should pass through a sieve with 6,400 meshes per sq. cm. In the field the road-dust used as a carrier has no effect on the larvae of Anophelines or Culicines, but in the laboratory some Culicine larvae were killed by it. A dust containing 1 per cent.of Paris green is poisonous to the larvae without affecting the uses of the water. On windy days a mixture of road-dust and very dry sand is the best carrier. Large larvae are more readily affected by Paris green than small ones. The dust should be applied every ten days. *Gambusia* has not yet been introduced into Turkey, but its employment to supplement dusting should control the larvae at very low cost.

MARCOVITCH (S.). & ANTHONY (M. V.). **A preliminary Report on the Effectiveness of Sodium Fluosilicate as compared with Borax in controlling the House Fly** (*Musca domestica* **Linné**).—*J. Econ. Ent.*, xxiv, no. 2, pp. 490–497, 1 fig., 7 refs. Geneva, N.Y., April 1931.

The following is the authors' abstract : Up to the present time borax has been considered the most practical chemical in the treatment of manure for the control of the larvae of *Musca domestica*, L. In a large series of insecticide tests, borax was found inferior to sodium fluosilicate in destroying fly maggots in manure. Neither material was found to possess ovicidal properties. Both borax and sodium fluosilicate act as stomach poisons, producing mortality when treated manure is actually eaten. Sodium fluosilicate, however, has the advantage of being much more toxic to either larvae or adults. In addition, sodium fluosilicate in amounts up to 300 lb. per acre has no detrimental effect on plant growth, whereas borax, in very small amounts, may prove harmful to certain sensitive plants such as *Citrus*. Since small maggots are more easily poisoned by chemical treatment than large ones, the best results will be obtained by sprinkling the manure with a saturated solution (1–154) of sodium fluosilicate each day.

TISCHLER (N.). **Reproductivity of Flies exposed to Pyrethrum Sprays.**—*J. Econ. Ent.*, xxiv, no. 2, p. 558. Geneva, N.Y., April 1931.

Experiments in which several hundred flies [*Musca domestica*, L.] were exposed to sprays of 1 lb. pyrethrum extract to 1 U.S. gal. kerosene disproved claims made by manufacturers that insects recovering from paralysis caused by exposure to such sprays are incapacitated so far as reproduction is concerned and so weakened that they are not potential pests. Those flies that recovered after the first and second days were placed in cages and given milk as food, and subsequent examination showed that they were active and fed readily, the females ovipositing and reproducing normally. Second and third generations were reared from flies exposed to pyrethrum sprays.

TISCHLER (N.). **A satisfactory Nutriment for Adult Houseflies.**—*J. Econ. Ent.*, xxiv, no. 2, p. 559. Geneva, N.Y., April 1931.

Two years' experience in the breeding of house-flies [*Musca domestica*, L.] showed that bread soaked in milk was an entirely adequate nutri-

ment for the adults. Several experiments in which flies were fed on milk alone in watch glasses proved that the bread serves merely as an absorptive medium. The flies live and breed normally on a milk diet alone, without the addition of yeast, meat broth, sugar, etc. Certain vitamin essentials may be supplied by fermentation, for milk is readily fermented at 85–90° F., the temperature at which the flies are reared. Flies must be fed at least twice and preferably three times a day, as otherwise high mortalities occur.

PARMAN (D. C.). **Notes on the Control of the Head Louse,** *Pediculus humanus capitis* **DeGeer, with Benzol.**—*J. Econ. Ent.*, xxiv, no. 2, p. 559. Geneva, N.Y., April 1931.

During the last 4 or 5 years commercially pure or 90 per cent. benzene has been used for the control of *Pediculus capitis*, DeG. It is either atomised or sprinkled over the head and rubbed in with the hands, as it appears necessary to moisten the eggs to make the treatment thorough. The head is then covered with a moist heavy towel until a burning sensation is felt, when the towel is removed and the hair dried. The benzene should be kept from the eyes and ears, as though no injury has been observed when it accidentally entered them, it causes pain for a few minutes. It should not be used near an open flame.

CARPENTER (C. D.). **The Use of Nicotin and its Compounds for the Control of Poultry Parasites.**—*J. Amer. Vet. Med. Assoc.*, lxxviii (N.S. xxxi), no. 5, pp. 651–656. Detroit, Mich., May 1931.

In using 40 per cent. nicotine sulphate against lice on poultry [*cf. R.A.E.*, B, xix, 139], it is recommended that the roosts should be painted with the undiluted material shortly before roosting time, at the rate of ½ lb. to each 100 ft. of roosts, including cross arms. If the roosts have been whitewashed, the lime should be completely removed beforehand [*cf.* xix, 140]. All the birds should be on the roosts for 2 successive nights following the application. Ventilators in the front of the house should be left open to provide sufficient air for the birds, but those behind or above the roosts should be closed to prevent the fumes being blown away too rapidly. The eggs of lice hatch in 6–10 days, and the birds should therefore be examined 10–12 days after treatment of the roosts to ascertain whether a second treatment is necessary. If lice are found, the treatment should be repeated immediately to prevent their reaching maturity and laying more eggs. Under good conditions two treatments a year should prove adequate. Nicotine is highly volatile at temperatures of 100–105° F. and is released by the body temperature of the fowl. The advantages of this method are that there is no handling of the bird, no loss in egg-production, roosting space for 1,000 birds can be treated in one hour, meat is not flavoured nor feathers stained, and supplies of the material are usually conveniently available. Free nicotine has not given such good results as nicotine sulphate, but nicotine alginate, a combination of free nicotine and alginic acid, has been found to remain on the roosts longer.

Cram (E. B.). **Developmental Stages of some Nematodes of the Spiruroidea parasitic in Poultry and Game Birds.**—*Tech. Bull. U.S. Dept. Agric.*, no. 227, 27 pp., 1 pl., 25 figs., 19 refs. Washington, D.C., February 1931.

During investigations on Spirurids infesting birds, the following Arthropods were found to be intermediate hosts of the Nematodes: the Coprids, *Phanaeus carnifex*, L. (*vindex*, MacL.) and *Copris minutus*, Drury, for a species of *Gongylonema*, tentatively identified as *G. ingluvicola* of fowls [*cf. R.A.E.*, B, xviii, 100]; the grasshoppers, *Melanoplus femur-rubrum*, DeG., and *M. differentialis*, Thomas, for *Tetrameres americana* [xviii, 99] and *Cheilospirura hamulosa* of fowls and *C. spinosa* of gallinaceous game birds [xviii, 100]; the cockroach, *Blattella germanica*, L., for *Seurocyrnea colini* of game birds; and the woodlice, *Porcellio scaber*, Latr., and *Armadillidium vulgare*, Latr., for *Dispharynx spiralis* of game birds.

In the case of the species of *Gongylonema*, a natural infection in dung beetles was discovered during investigation on the Spirurid, *Physocephalus sexalatus*, of pigs, for which the beetles serve as intermediate hosts. In the case of the other five Nematodes, all stages of the life-cycle were experimentally produced and their development in the intermediate and final hosts is described. The following reached the adult stage in poultry: *T. americana* in fowls, ducks and pigeons; *C. hamulosa* in fowls; and *D. spiralis* in pigeons.

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Colcord (M.). **Index IV to the Literature of American Economic Entomology, January 1, 1925 to December 31, 1929.**—*Amer. Assoc. Econ. Ent.*, Spec. Pub. 4, [xii]+518 pp. Melrose Highlands, Mass., 1930. Price $5·50. [*Cf. R.A.E.*, B, xiii, 154.]

Stoddard (H. L.). **The Bobwhite Quail** [*Colinus virginianus*], **its Habits, Preservation and Increase** [including a chapter on its external parasites].—Super Roy 8vo, xxix+559 pp., 69 pls., 32 figs. New York, Charles Scribner's Sons, 1931. Price 30*s*.

Martini (E.). **Die Ausbeute der deutschen Chaco-Expedition 1925-26.** [Results of the German Chaco Expedition 1925–26.]—**Diptera. XXV. Culicidae.**—*Konowia*, x, no. 2, pp. 116–120. Vienna, July 1931.

Toumanoff (C.). **Sur une variété nouvelle** [**var.** *tonkinensis*] **d'***Anopheles aconitus* **Dönitz observée au Tonkin.**—*C.R. Soc. Biol.*, cvii, no. 19, pp. 575–576, 1 ref. Paris, 1931.

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Galliard (H.). **Culicides du Gabon. I. Culicinés, avec la description d'une espèce et de deux variétés nouvelles.**—*Ann. Paras. hum. comp.*, ix, no. 3, pp. 225–232, 4 figs. Paris, May 1931.

Nitzulescu (V.). **Sur un phlébotome nouveau du Venezuela,** *P. gomezi* **n. sp.** [described from the female].—*Ann. Paras. hum. comp.*, ix, no. 3, pp. 247–255, 1 pl., 6 figs., 14 refs. Paris, May 1931.

ENDERLEIN (G.). *Aphopeas*, **eine neue Tabanidengattung von Neu-Seeland.** [*Aphopeas*, a new Tabanid Genus from New Zealand.]—*SitzBer. Ges. naturf. Fr. Berlin*, 1930, pp. 102–103. Berlin, 1930.

ENDERLEIN (G.). **Die von Dr. Erich Schmidt in Algier gesammelten Tabaniden.** [Tabanids collected by Dr. E. Schmidt in Algeria.]—*SitzBer. Ges. naturf. Fr. Berlin*, 1930, pp. 376–385, 2 figs. Berlin, 1931.

SCHUURMANS STEKHOVEN, jr. (J. H.). **Our present Knowledge about the Pupipara and Tabanidae of China.**—*Lingnan Sci. J.*, vii (1929), pp. 497–510, 2 pp. refs. Canton [1931].

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BEDFORD (G. A. H.). *Nuttalliella namaqua*, **a new Genus and Species of Tick.**—*Parasitology*, xxiii, no. 2, pp. 230–232, 1 pl., 1 fig., 1 ref. Cambridge, May 1931.

SCHULZE (P.). **Einige neue chinesische Ixodiden** (*Haemaphysalis, Dermacentor*). [Some new Chinese Ixodids.]—*SitzBer. Abh. naturf. Ges. Rostock*, (3) iii, pp. 49–54, 5 figs. Rostock, 1931.

WIGGLESWORTH (V. B.). **Effect of Desiccation on the Bed-bug** (*Cimex lectularius*).—*Nature*, cxxvii, no. 3200, pp. 307–308, 2 figs. London, 28th February 1931.

WIGGLESWORTH (V. B.). **A curious Effect of Desiccation on the Bed-bug** (*Cimex lectularius*).—*Proc. Ent. Soc. Lond.*, vi, pt. 1, pp. 25–26. London, July 1931.

ÔTA (M.). **Etude expérimentale sur le venin de la punaise des lits** [*Cimex lectularius*, L.]. [*In Japanese.*]—*Japan. J. Dermat. Urol.*, xxx, no. 9, pp. 966–976, 1 fig., 6 refs. September 1930. (With a Summary in French, pp. 100–102.) (Abstract in *Trop. Dis. Bull.*, xxviii, no. 7, p. 543. London, July 1931.)

WAGNER (J.). **Nachträge zum** [Supplement to the] **Kataloge der palaearktischen Aphanipteren (Wien 1930).**—*Konowia*, x, no. 2, pp. 96–100, 13 refs. Vienna, July 1931. [*Cf. R.A.E.*, B, xviii, 160.]

JORDAN (K.). **Flöhe aus Venezuela.**—*Z. Parasitenk.*, iii, no. 2, pp. 264–266, 1 fig. Berlin, 20th April 1931.

[ZASUKHIN (D. N.).] **Засухин (Д. Н.). Lebensbedingungen, Cytologie und Entwicklung von** [Conditions of Life, Cytology, Structure and Development of] *Endamoeba blattae* **(Bütschli) Leidy (1879).** [*In Russian.*]—*Arch. russes Protistologie*, viii, no. 3–4, pp. 163–244, 10 figs., 4 pls., 2 pp. refs. Moscow, 1929. [Recd. 1931.] (With a Summary in German.)

PETERS (H. S.). **A new Louse** [*Lipeurus tropicalis*, sp. n.] **from domestic Chickens (Mallophaga : Philopteridae)** [in the Bahamas].—*Ent. News*, xlii, no. 7, pp. 195–199, 2 figs. Philadelphia, Pa., July 1931.

SALING (T.). **Die Bedeutung des T-Gases (Aetox) für die Bekämpfung von Gesundheits-, Wohnungs- und Vorratsschädlingen.** [The Importance of T-Gas (a mixture of ethylene oxide and carbon dioxide) for the Control of Household and Stored Product Pests.]—*Z. Desinfekt.*, xxiii, no. 4, pp. 171–175. Dresden, April 1931. [See *R.A.E.*, A, xix, 461.]

WILLIAMS (C. L.). **Fumigants.**—*Publ. Hlth. Rep.*, xlvi, no. 18, pp. 1013–1031. Washington, D.C., 1st May 1931. [See *R.A.E.*, A, xix, 478.]

MAW (W. A.). **The Northern Fowl Mite,** *Liponyssus sylviarum,* **of Poultry.**—*Sci. Agric.*, xi, no. 10, p. 710, 5 refs. Ottawa, June 1931.

Liponyssus sylviarum, C. & F., which had only been recorded twice in Canada, in Ontario in 1922 and in British Columbia in 1929, was observed during the early part of 1931 infesting fowls and eight species of wild birds in Quebec. The mites remain on the fowls throughout the day and may be seen on the plumage. Nicotine sulphate applied to the roosts [*cf. R.A.E.*, B, xix, 182] has not proved satisfactory in all cases but may be more effective as a spray. An oil "fly-spray" applied amongst the plumage has given good results. A fine sulphur dust is recommended for use in cold weather, but in summer dipping is usually more satisfactory, 1 oz. soap and 2 oz. sulphur being used in warm water. All birds attacked by *L. sylviarum* should receive immediate attention, as severe injury may result from an excessive drain on their blood-supply.

OLDHAM (J. N.). **On the Arthropod intermediate Hosts of** *Hymenolepis diminuta* **(Rudolphi 1819).**—*J. Helminth.*, ix, no. 1, pp. 21–28. London, February 1931.

A briefly annotated list is given of the Arthropods that have been recorded as acting habitually or experimentally as intermediate hosts of the Cestode, *Hymenolepis diminuta*. These are, the millepedes, *Fontaria virginiensis* and *Julus* sp.; the Blattids, *Blatta* (*Periplaneta*) *orientalis*, L., *P. americana*, L., and *Blattella germanica*, L.; the earwig, *Anisolabis annulipes*, Lucas; the moths, *Tinea granella*, L., *T. pellionella*, L., *Aglossa dimidiata*, Haw., *Aphomia gularis*, Zell., and *Pyralis farinalis*, L.; the fleas, *Leptopsylla musculi*, Dugès, *Ceratophyllus fasciatus*, Bosc, *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., *Pulex irritans*, L., and *Xenopsylla cheopis*, Roths.; and the beetles, *Dermestes peruvianus*, Cast., *Geotrupes sylvaticus*, Panz., *Akis spinosa*, L., *Scaurus striatus*, L., *Tenebrio molitor*, L., *Tribolium castaneum*, Hbst., and *Ulosonia parvicornis*, Fairm.

In experiments, which are described, the younger larvae of *Ceratophyllus wickhami*, Baker, were found to feed on the eggs of *H. diminuta*, cysticercoids being observed in some of the resulting adults when examined three weeks later.

BISHOP (S. C.) & HART (R. C.). **Notes on some natural Enemies of the Mosquito in Colorado.**—*J. N.Y. Ent. Soc.*, xxxix, no. 2, pp. 151–157, 1 ref. New York, N.Y., June 1931.

Notes are given on certain hitherto unnoticed predacious enemies of mosquitos encountered in the course of biological field work in the San Luis Valley, Colorado. Vertebrate predators include a frog (*Rana pipiens*), a cricket frog (*Pseudacris*), a toad (*Bufo*) and the larva of the tiger salamander (*Amblystoma tigrinum*). A number of flies observed attacking mosquito larvae in a small gravel pit were identified as *Dolichopus renidescens*, Melander & Brues, *D. nigricauda*, M.C.A., *D. appendiculatus*, M.C.A., and *D. walkeri*, M.C.A. In a laboratory experiment with *D. walkeri*, which was apparently the most abundant species, 93 mosquito larvae were consumed in 7 days, mostly by two small flies. In a further laboratory experiment with the Lycosid,

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Pardosa sternalis, which was found in the same pool, 4 spiders took 57 mosquito larvae and pupae between 27th June and 3rd July.

A comparative account is given of the natural enemies of mosquitos breeding in permanent and transient waters. The Phyllopod, *Streptocephalus sealii*, was found in conjunction with large numbers of developing mosquito larvae in a ditch that was dry during a part of the year. These crustaceans were absent from all adjacent ponds and sloughs of an obviously permanent character. The snail, *Lymnaea palustris*, was found to be an active predator. Laboratory experiments determined that snails actively kill both larvae and pupae of mosquitos, and observations indicated that they were responsible for the almost entire absence of the latter in a roadside ditch. A further investigation demonstrated that in every instance where snails were abundant mosquito larvae were so few in number as to be negligible.

Tulloch (G. S.). **Mosquito Control in Massachusetts.**—*Psyche*, xxxviii, no. 1, pp. 38–40. Boston, Mass., March 1931.

Particulars are given of work carried out in Massachusetts which has resulted in a large measure of control of the salt marsh mosquito, *Aëdes sollicitans*, Wlk., by means of ditching operations and the building of a large dyke, and of fresh water species by ditching, oiling, etc. The problem was complicated by the presence of *Taeniorhynchus* (*Mansonia*) *perturbans*, Wlk., the larva of which attaches itself to roots and stems of aquatic plants and which can only be controlled by complete removal of the water.

Botsford (R. C.). **Mosquito Control in Connecticut, 1930.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 327, pp. 567–572. New Haven, Conn., April 1931.

The work on mosquito control in Connecticut during 1930 was continued on similar lines as in previous years [*cf. R.A.E.*, B, xviii, 212].

Manalang (C.). **Malaria Transmission in the Philippines. I. The natural Vector.**—*Philipp. J. Sci.*, xlv, no. 2, pp. 241–248, 1 pl., 1 map. Manila, June 1931.

Further dissections of Anophelines taken in ten other places in the Philippine Islands [*cf. R.A.E.*, B, xvii, 64], during a period of two years, show conclusively that of the 12 species of which large numbers were examined, *A. minimus*, Theo. (which the author treats as a synonym of *A. funestus*, Giles), which was found to be the vector of malaria in 1927, is the natural vector of the disease in the Philippines.

Sarkar (S. L.). **A Malaria Survey in Noakhali District, Bengal.**—*Ind. Med. Gaz.*, lxvi, no. 6, pp. 322–326, 1 map. Calcutta, June 1931.

An account is given of an Anopheline survey conducted during February-March 1930, in certain localities in the Noakhali district, Bengal, with a brief discussion on the incidence of malaria in each. The nine Anophelines collected include the following species that are known vectors of malaria: *Anopheles aconitus*, Dön., *A. fuliginosus*, Giles, *A. philippinensis*, Ludl., and *A. minimus* var. *varuna*, Iyengar.

Patino Camargo (L.). **Saneamento de la región palúdica de San Cayetano.** [The Drainage of the malarial District of San Cayetano, Colombia.]—*Repert. Med. y Cirurg.*, xxi, no. 1, reprint 28 pp., 12 figs. Bogotá, January 1930. [Recd. June 1931.]

An account is given of the control of mosquitos by draining and filling up their breeding-places at San Cayetano, Colombia, where malaria is rife, the Anophelines present being *Anopheles argyritarsis*, R.-D., *A. apicimacula*, D. & K., and *A. pseudopunctipennis*, Theo.

Shannon (R. C.). **On the Classification of Brazilian Culicidae with special Reference to those capable of harboring the Yellow Fever Virus.**—*Proc. Ent. Soc. Wash.*, xxxiii, no. 6, pp. 125–164, 7 pls., 2 pp. refs. Washington, D.C., June 1931.

The relation between the habits of adult mosquitos and their external characters is discussed, and keys are given to the tribes and genera of the Brazilian Culicines, the sub-genera and species of *Psorophora*, *Taeniorhynchus* (*Mansonia*) and *Aëdes*, and the larvae of species of the last two, with a description of *T.* (*M.*) *lynchi*, sp. n. In a note on the species of *Anopheles* (*Chagasia*), the author states that from each of two types of pupae, resembling those of *A. fajardoi*, Lutz, and *A. bonneae*, Root, that were collected in Bahia, males of both types were obtained, and concludes that *A. bonneae* is a synonym of *A. fajardoi*. *A.* (*Stethomyia*) *lewisi*, sp. n., is described from Bahia.

Roubaud (E.). **Recherches expérimentales sur les générations et les phases biologiques de l'** *Anopheles maculipennis*.—*Riv. Malariol.*, x, no. 1, pp. 1–42, 12 figs., 1 pl. Rome, 1931. (With Summaries in Italian p. 154, French p. 155, English p. 157, German p. 159.)

Hibernation and aestivation in Anophelines far from being directly caused by winter cold or summer dryness are due to asthenobiosis [*R.A.E.*, B, xiv, 123]. This state of spontaneous inactivity may occur in the larvae, as in the case of *Anopheles bifurcatus*, L., and *A. plumbeus*, Steph., or in the adult females, as in *A. maculipennis*, Mg. [*cf.* xi, 162–165]. In Holland, the winter inactivity of *A. maculipennis* has given rise to the view that two races of this mosquito occur there, of which the smaller one, *A. maculipennis* var. *atroparvus*, van Thiel, has a reduced development of the fat-body in winter and feeds during that season [xv, 181, etc.], and that the existence of malaria in Holland is due to winter transmission by this variety. The author was the first to point out that in regions where zooprophylaxis is established, malaria can only persist in virtue of asthenobiosis which causes an increase of the mosquitos sheltering in winter-quarters (dwellings) and exposes man to attack [xviii, 53], so that a residual malaria due to *Plasmodium vivax* continues to exist. The continuance of malaria in European regions well protected by cattle is, however, an exception. The author doubts whether local races of *A. maculipennis* are involved; malaria has disappeared in Vendée, where *A. maculipennis* attacks man during the winter. The taking or avoidance of blood-meals are not racial characters, but appear to be due to conditions of larval development,

which are variable. The views of workers in Holland render necessary a biological study of Anopheline races from this point of view.

The author has therefore undertaken experiments, the technique of which is described, on the physiology of the phenomenon of winter asthenobiosis and the conditions of its appearance in series of generations of *A. maculipennis*. In other experiments the feeding habits and oviposition of the various generations have been observed. Similar work by various investigators is briefly reviewed. The original females used were all from the same area, being collected in stables in Vendée in September.

A. maculipennis seems to have 3 or 4 generations a year in nature. The annual cycle, with generations varying in number locally, is spontaneously interrupted by asthenobiosis in the females. Such females may accept or refuse blood-meals, but they fail to oviposit during many months. Asthenobiosis may, exceptionally, occur with the first post-hibernating generation, but its occurrence becomes more frequent with each succeeding generation. In nature, asthenobiosis probably occurs more regularly than in the laboratory because it can more definitely respond to cyclic fatigue. The laboratory results, however, confirm observations in nature that asthenobiosis is due to internal physiological conditions and not to any external influence. In the present state of research the physiological conditions of hibernating females can only with difficulty be interpreted as characters of true races. Breeding experiments have proved that the aptitude to feed on blood and to become fat is extremely variable in the descendants of a given mosquito.

DAVIS (N. C.). **A Note on the Malaria-carrying Anophelines in Belém, Pará, and in Natal, Rio Grande do Norte, Brazil.**—*Riv. Malariol.*, x, no. 1, pp. 43–51, 7 refs. Rome, 1931. (With Summaries in Italian p. 154, French p. 156, English p. 158, German p. 159.)

The Anophelines found in the environs of Belém in April 1930 were: *Anopheles darlingi*, Root, *A. tarsimaculatus*, Goeldi, *A. intermedius*, Chagas, *A. shannoni*, Davis, *A. mediopunctatus*, Theo., and *A. nimbus*, Theo. In 200 specimens of *A. darlingi* caught in houses there was a malarial infection rate of 22 per cent., 5 per cent. of 181 salivary glands examined being infected. Filarial embryos, assumed to be *Filaria* (*Wucheria*) *bancrofti*, were found in 14 specimens of *A. darlingi*, in one instance both in the head and the proboscis. Of 25 persons from the infected district, 5 showed *F. bancrofti* in the blood. *A. tarsimaculatus* seemed to prefer animal blood. Only a few adults were found in houses, and none of these was infected. Though not eliminated as a transmitter of malaria, it can only be of minor importance. In March 1930, *A. gambiae*, Giles, was discovered at Natal [*R.A.E.*, B, xviii, 150], having probably been introduced from Africa. By May the malaria situation had become serious. In 172 specimens, caught in houses, there was a malarial infection rate of 62·8 per cent., including 32 per cent. of salivary gland infections. *A. tarsimaculatus* and *A. bachmanni*, Petrocchi, were at times associated with *A. gambiae* out of doors, where the latter chiefly occurred. The indices given are said to be without precedent in the literature on malaria.

van Thiel (P. H.). *Anopheles maculipennis* **et la variété** *atroparvus* ; **un problème de l'anophélisme sans paludisme.**—*Acta Leidensia Sch. Med. trop.*, v, pp. 193–195. Leiden, 1930. [Recd. May 1931.]

In this paper read before the Second International Congress on Malaria at Algiers in 1930, the existence in Holland of *Anopheles maculipennis*, Mg., var. *atroparvus*, van Thiel, is discussed [*R.A.E.*, B, xv, 180], with notes on experiments made to test criticisms by Achundow [xix, 143].

Swellengrebel (N. H.) & de Buck (A.). **Correlation between intestinal and salivary Infection in** *Anopheles maculipennis.*—*Proc. K. Akad. Wetensch. Amsterdam*, xxxiv, no. 1, pp. 183–185. Amsterdam, 1931.

There is a general tendency to cast doubt upon the results of investigations on the rate of malaria infection in Anophelines if based on dissections of the stomach only. The authors' experiments in infecting *Anopheles maculipennis*, Mg., with benign tertian malaria [*Plasmodium praecox*], however, indicate that the rate of infection of the salivary glands is closely correlated with that of the stomach. Twenty-three batches of mosquitos were infected, the average number in each being 59 at the commencement of the experiment and 28 by the time the sporozoites invaded the salivary glands. In the mosquitos that survived for the necessary periods, the average oöcyst rate was 45 per cent. and the average sporozoite rate 47 per cent. This result not only shows the close correlation between the two rates, but also suggests that in studies of natural infection the oöcyst rate would give more accurate data than the sporozoite rate, as in various investigations in the past, the former has almost always considerably exceeded the latter. As doubts of the accuracy of estimates based on the oöcyst rate have mainly originated in connection with investigations on *A. maculipennis*, the authors consider it probable that this conclusion would apply to other species as well.

van Thiel (P. H.). **Die Entwicklung von** *Agamodistomum anophelis* **zum** *Pneumonoeces variegatus* **Rud.** [The Development of *A. anophelis* to *P. variegatus*.]—*Zbl. Bakt.* (1, Orig.), cxvii, no. 1–3, pp. 103–112, 3 figs., 20 refs. Jena, 3rd June 1930.

In a previous paper it was stated that *Pneumonoeces variegatus*, obtained from the lungs of the frog, *Rana esculenta*, near Leiden, is probably the ultimate form of *Agamodistomum anophelis*, which is found encysted in larvae and adults of *Anopheles maculipennis*, Mg., and is a stage of *Cercaria anophelis*, occurring in the snail, *Planorbis vortex* [*R.A.E.*, B, xiii, 182]. This has now been proved by experiments described here in which *P. variegatus* developed in the lungs of frogs fed on infected Anopheline larvae. *A. anophelis* and *C. anophelis* are thus synonyms of *P. variegatus*.

[Symes (C. B.).] **Section of Medical Entomology.**—*Rep. Med. Res. Lab. Kenya 1929*, pp. 23–25. Nairobi, 1931.

In malaria investigations in Kenya during 1929, it was found that in one locality a general infestation of *Anopheles funestus*, Giles, became

superimposed by one of *A. gambiae*, Giles (*costalis*, Theo.) during the wet season, and this was apparently followed by an increase in malaria cases. *A. funestus* has been found naturally infected in one locality in Kenya, and since it appears to be more numerous in blackwater areas than in others, its association with quartan malaria requires to be investigated. Two Anophelines that are either new or are varieties of *A. transvaalensis*, Cart., and *A. natalensis*, Hill and Haydon, respectively, were discovered during the year.

Hopkins (G. H. E.). **Report of the Medical Entomologist.**—*Ann. Rep. Lab. Serv. Div. Uganda 1930*, pp. 20–23. Entebbe, 1931.

Mosquito breeding-places in Kampala are further discussed [*R.A.E.*, B, xix, 69], and an account is given of a mosquito survey of Jinja. Anophelines not included in the previous list [xviii, 241] are *Anopheles symesi*, Edw., *A. moucheti*, Evans, *A. nili*, Theo., *A. maculipalpis*, Giles, *A. rufipes*, Gough, *A. kingi*, Christ., and *A. garnhami*, Edw.

Gibbins (E. G.). **Report by the Laboratory Assistant.**—*Ann. Rep. Lab. Serv. Div. Uganda 1930*, pp. 24–28, 1 graph. Entebbe, 1931.

The percentages of female Anophelines captured in selected observation huts during the Kampala survey were 5·9 of *Anopheles theileri*, Edw., 43·4 of *A. funestus*, Giles, and 50·7 of *A. gambiae*, Giles. The percentage of malaria infection in *A. gambiae* varied from 14·3 to 24·9, in *A. funestus* from 13 to 17·7 and in *A. theileri* from 0 to 19·9 [*cf. R.A.E.*, B, xix, 69]. Maturation of oöcysts took longer in *A. theileri* than in the other two species. Throughout the twelve months *A. gambiae*, which was characterised by a marked seasonal prevalence, and *A. funestus* were abundant. The former was scarce in November during a break in the long rains, the latter in the dry interval of July prior to the rains and the wet month of October, and *A. theileri* at the close of the dry season. It is probable that *A. funestus* may play the most important part in the transmission of malaria at certain seasons owing to acceleration in the development of sporozoites at a period when this phenomenon is retarded in *A. gambiae*.

The survey of the mosquito fauna of Jinja covered the period June–September, which almost coincided with the dry season. *A. funestus* was abundant in houses, *A. gambiae* being caught there in comparatively small numbers. *A. pharoensis*, Theo., chiefly occurred in huts in the near vicinity of its breeding-grounds. *A. moucheti*, Evans, was common in the neighbourhood of the River Nile, being found in extremely large numbers, to the practical exclusion of other species, in native huts in certain localities ; *A. nili*, Theo., was taken on rare occasions with it. *A. mauritianus*, Grp., which undoubtedly attacks man, was commonly captured engorged with blood in human dwellings, though it has not been found infected with malaria. Its occurrence in houses in unusual numbers coincided with the presence of goats. The prevalence of different mosquitos in various dwellings is discussed.

Embryos of *Filaria* were found in the thorax of 7 specimens of *A. funestus* and in one of *A. mauritianus*, and in the latter and one of the former they were active in the proboscis. Of 102 specimens of *Taeniorhynchus* (*Mansonioides*) *uniformis*, Theo., dissected during August and September, one showed fourteen active microfilariae in the thorax.

JACKSON (C. H. N.). **An Experiment on the Feeding Habits of** *Glossina swynnertoni* **(Dipt.).**—*Bull. Ent. Res.*, xxii, pt. 2, pp. 175–181. London, June 1931.

An account is given of an experiment with marked individuals of *Glossina swynnertoni*, Aust., carried out from 17th July to 30th August in Shinyanga, Tanganyika Territory, with a view to corroborating the "feeding-ground" concept as applied to *G. morsitans*, Westw. [*R.A.E.*, B, xix, 62] and, at the same time, to proving that these species have similar habits. It was found that the hungrier flies precede the more replete ones from the bush to the open glade, which therefore may be considered to be their feeding-ground, and that flies visit the feeding-ground about every fifth day. Examination of the records of individuals several times recaptured suggests that five days is about the time taken by flies to complete their hunger cycle.

DE MEILLON (B.). **Notes on the Larvae of some South African Anophelines.**—*Bull. Ent. Res.*, xxii, pt. 2, pp. 237–243, 7 figs., 9 refs. London, June 1931.

The extent to which the larvae of South African Anophelines can be grouped as suggested by Puri [*R.A.E.*, B, xvii, 31] is discussed. Characters are given for the separation of the larvae of *A. natalensis*, Hill & Haydon, and *A. ardensis*, Theo., and a variation in some larvae of *A. squamosus*, Theo., from Zululand is noted. Differences between the larva of the typical form of *A. theileri*, Edw., in South Africa and the larva described as this species from Sierra Leone [xiv, 64] are discussed, and indicate that the latter belongs to a variety of this species, which the author considers to be *A. theileri* var. *brohieri*, Edw. [but *cf.* xix, 174].

[VARASHI (V.).] WARASI (W.). **Zur Biologie der Anopheleslarven.** (*Anopheles maculipennis* **Mg. in Verbindung mit den Wasserfaktoren in Kalchis.**) [The Biology of Anopheline Larvae. *A. maculipennis* in Connection with the Characteristics of Water infested by the Larvae in Kalkhis.]—*Arch. Schiffs- u. Tropenhyg.*, xxxv, no. 6, pp. 336–345, 24 refs. Leipzig, June 1931.

Observations on the breeding-places of *Anopheles maculipennis*, Mg., in Kalkhis, West Georgia, show that the optimum temperature for larval development apparently lies between 20 and 27° C. [68 and 80·6° F.]. Larvae were absent in water exposed to strong direct sunshine or entirely shaded. It was found that variations in pH between 5·8 and 7·7, in oxygen (O_2) content between 5·2 and 10·6 mg. per litre and in carbon dioxide (CO_2) content between 1·8 and 18 mg. per litre do not affect development. The opinion that oxygen concentration within certain limits is useful to the larvae is not borne out in nature. The presence of nitric acid, nitrous acid or dissolved organic material in concentrations above 135 mg. per litre, or of sulphuric acid is harmful, as is also ammonia (NH_3) in large amounts, such as 27 mg. per litre. Hardness between 0·75 and 6·28 German degrees and a content of 80 mg. per litre of combined carbonic acid do not seem to affect the larvae. The author's observations confirm the view that a reduction in the calcium and magnesium salts present does not hinder development if there is a favourable hydrogen-ion concentration. All the natural waters examined were fresh, with a maximum chlorine content of 60 mg. per litre.

BRAGINA (A.). **Beiträge zur Kenntnis der mazedonischen Culiciden nebst einigen Bemerkungen allgemeiner Art.** [Contributions to the Knowledge of Macedonian Culicidae with some Observations of a general Nature.]—*Arch. Schiffs- u. Tropenhyg.*, xxxv, no. 6, pp. 345–353, 3 figs., 12 refs. Leipzig, June 1931.

The mosquitos that have been found to occur in stables in Macedonia are: *Anopheles maculipennis*, Mg., *A. superpictus*, Grassi, *A. hyrcanus*, Pall., *Aëdes caspius*, Pall., *Taeniorhynchus* (*Mansonia*) *richiardii*, Fic., *Culex pipiens*, L., *C. theileri*, Theo., and *C. apicalis*, Adams. Several engorged individuals of *T. richiardii* were taken in one stable in 1930 [*cf. R.A.E.*, B, ix, 92], to which they must have flown from a distance, as no larvae occurred in possible breeding-places in the vicinity. Larvae of *Culex hortensis*, Fic., frequently occurred in association with those of *A. maculipennis* [ix, 91].

Larvae of the following species were found in the vicinity of Skoplje in 1930: *Culex modestus*, Fic., *C. mimeticus*, Noé, *Uranotaenia unguiculata*, Edw., *Aëdes vexans*, Mg., *Theobaldia annulata*, Schr., which probably has two generations a year, *A. maculipennis*, *A. superpictus*, and *A. bifurcatus*, L. In Belgrade, *A. maculipennis* bites as early as March. The frequent occurrence of dead mosquitos half enclosed in the pupal case was found to be due to the water-bug, *Microvelia schneideri*, Schtz., which attacks the adult as it emerges.

NIESCHULZ (O.) & BOS (A.). **Erfahrungen beim Experimentieren mit Mücken.** [Experiments with Mosquitos.]—*Arch. Schiffs- u. Tropenhyg.*, xxxv, no. 6, pp. 353–356, 2 figs. Leipzig, June 1931.

This paper describes a new form of cage that facilitates feeding mosquitos on birds and mammals. It consists of an oblong frame (4 ins. long, $2\frac{3}{4}$ ins. high, and 2 or 4 ins. wide, according to the number of mosquitos) of iron wire covered with gauze except at one end to which is attached a sleeve through which the mosquitos are introduced. The lower edges of the two long side-walls are reinforced with narrow rubber bands, there being no wire along them. By adjusting the gauze tightly, these two edges become slightly concave, and the bottom of the cage thus fits closely against the body of the animal. At the four corners of the bottom, the wire forming the frame is prolonged to form hooks by which the cage can be strapped to it with rubber bands passed round its body. When a horse is used, the hooks are secured to strips of fabric that are then attached to the skin with collodion.

ROSEN (G.). **Beobachtungen über die Theileriasis annulata während eines epidemischen Auftretens dieser Krankheit.** [Observations on Theileriasis during an Epidemic of this Disease.]—*Arch. Schiffs- u. Tropenhyg.*, xxxv, no. 6, pp. 373–378. Leipzig, June 1931.

In May 1930 an epidemic of theileriasis occurred on cattle at Dagania, a settlement in the Jordan Valley. Neighbouring localities were not affected. The outbreak is believed to have been due to ticks, *Hyalomma aegyptium*, L., and *Boophilus* sp., that were introduced on imported barley straw.

ZIEMANN (H.). **Ueber die etwaigen Beziehungen gewisser cumarinhaltiger Pflanzen zur Epidemiologie der Malaria.** [On the possible Relation of certain Plants containing Coumarin to the Epidemiology of Malaria.]—*Arch. Schiffs- u. Tropenhyg.*, xxxv, no. 7, pp. 410–420. Leipzig, July 1931.

With reference to the evidence for and against the theory that the cultivation of leguminous crops affords protection against malaria [*R.A.E.*, B, xvi, 26 ; xviii, 143], observations in the support of it in the Caucasus by Krysto are noticed. Two long lists of plants containing coumarin are given, prepared by Dr. K. Braun and Dr. Liebisch respectively.

CHODUKIN (N. J.), SOFIEFF (M. S.), SCHEVTSCHENKO (F. J.) & RADSIVILOVSKIJ (G. L.). *Phlebotomus* **als Ueberträger von Hunde-Leishmaniose.** [*Phlebotomus* as Carriers of Canine Leishmaniasis.] —*Arch. Schiffs- u. Tropenhyg.*, xxxv, no. 7, pp. 424–434, 2 figs. Leipzig, July 1931.

In continuation of work already noticed [*cf. R.A.E.*, B, xix, 55], experiments have been made in Tashkent to ascertain if canine leishmaniasis was transmitted by sandflies. Healthy young dogs and a diseased one were placed in adjoining compartments in a chamber separated with wire gauze, and sandflies, *Phlebotomus papatasii*, Scop., and *P. sergenti*, Parrot, introduced. Transmission was successful, but it is not possible to say which of the two species was responsible.

HINDLE (E.). **The Development of various Strains of *Leishmania* in Chinese Sandflies.**—*Proc. Roy. Soc.* (B) cviii, no. B 758, pp. 366–383, 7 refs. London, 1st July 1931.

The results of experiments, conducted in China, in which *Phlebotomus chinensis*, Newst., and *P. sergenti* var. *mongolensis*, Sinton, were fed on hamsters (*Cricetulus*) artificially infested with the Indian strain of *Leishmania donovani*, show that this particular strain does not develop as readily in these midges as does the Chinese one [*cf. R.A.E.*, B, xv, 177]. Of 47 individuals of *P. chinensis*, only 12 gave positive results. With three exceptions they showed very scanty infection, and in every instance the flagellates were free in the hinder part of the stomach, there being no suggestion of the anterior development and attachment of them to the wall of the gut, as in the case of the Chinese strain. Of 464 individuals of *P. sergenti* var. *mongolensis* dissected, mostly after an interval of 4 days, flagellates were only found in 29. The type of development was similar in both the Indian and the Chinese strains of *L. donovani*, the flagellates being confined to the hinder part of the stomach, and never becoming attached to the wall of the alimentary canal.

Of 41 individuals of *P. chinensis* fed on hamsters infected with *L. infantum* from Tunis, only 4 showed the presence of flagellates in the stomach, and three of these were only slightly infected ; one individual fed artificially by a method already described [*cf.* xv, 160] with a rich culture of this strain showed no flagellates when dissected the next day. In the case of *P. sergenti* var. *mongolensis*, of 573 midges, only 18 showed the presence of living flagellates, and two others contained degenerating ones.

Of 5 individuals of *P. sergenti* var. *mongolensis* and 2 of *P. chinensis*, fed on cultures of a strain of *L. tropica* from Bagdad, 2 and 1 respectively became infected.

Experiments in which individuals of *P. squamirostris*, Newst., were fed on cultures and suspensions of the Chinese strain of *L. donovani* show that this strain is capable of developing in this species up to the flagellate stage. Attempts to feed them on infected hamsters, however, gave negative results.

Gil Collado (J.). **Nota sobre el "Je-Jen" de Fernando Póo.** [A Note on a Sandfly in Fernando Po.]—*Med. Paises calidos*, iv, no. 3, pp. 236–240, 2 figs., 6 refs. Madrid, May 1931.

Differences between *Culicoides hostilissimus*, Pittaluga, and *C. grahami*, Aust., are described, in view of the fact that these species have been confused. The species found in the island of Fernando Po is considered to be *C. hostilissimus*.

Zavattari (E.). **Note di parassitologia Cirenaica.**—*Giorn. Clin. med.*, no. 13, suppl., *Boll. Soc. ital. Med. Igiene colon.*, reprint 11 pp. Parma, 1930.

Except for the Saharan oases, Anopheline mosquitos are practically absent from Cirenaica, this coinciding with the absence of malaria. Franchini's record of *Anopheles hyrcanus* var. *pseudopictus*, Grassi, at Derna must be regarded as quite exceptional [*R.A.E.*, B, xvii, 143]. *Aëdes argenteus*, Poir., is rare and almost confined to the region of Bengasi. *Theobaldia longiareolata*, Macq., is more common. *Culex pipiens*, L., is abundant, particularly on the coast. The only blood-sucking Chironomids are some Ceratopogonines of which some three or four species have been identified. Sandflies and leishmaniasis are almost entirely absent. Larvae and pupae of *Simulium equinum*, L., and *S. latipes*, Mg., were taken in numbers on reeds at Derna. Tabanids are common in the oasis of Giarabub, where trypanosomiasis of camels occurs. *Stomoxys calcitrans*, L., is widespread. *Hippobosca camelina*, Leach, on camels, *H. equina*, L., on horses and *H. capensis*, Olf., on dogs, are all very common, and *Melophagus ovinus*, L., occurs on sheep and goats. The tick, *Ornithodorus savignyi*, Aud., was found in numbers in the sand at a resting place for camels at an oasis.

Colas-Belcour (J.). **Notes sur la faune parasitologique des Oasis de Tozeur et Kébili.**—*Arch. Inst. Pasteur Tunis*, xx, no. 1, pp. 66–72, 17 refs. Tunis, April 1931.

Notes are given on Culicine larvae collected in January and February, 1930, during a study of the parasitic Arthropods occurring in these oases. These included those of *Culex pipiens*, L., *Theobaldia annulata*, Schr., *T. longiareolata*, Macq., *Aëdes detritus*, Hal., and *A. caspius*, Pall. The larvae and nymphs of *Simulium equinum*, L. [var. *mediterraneum*, Puri] were also taken.

Parasites found on domestic animals included *Linognathus* (*Haematopinus*) *stenopsis*, Burm., and a nymph of *Hyalomma* sp. on goats; *Melophagus ovinus*, L., *Hyalomma lusitanicum*, Koch, and its variety, *algericum*, Senevet, on sheep; and *H. lusitanicum*, *H. aegyptium dromedarii*, Koch, and *H. aegyptium impressum*, Koch, on camels. Only one individual of *Hippobosca camelina*, Leach, was observed on a

camel. The scarcity of *Ornithodorus savignyi*, Aud., indicates that though this tick might be more abundant in summer, it does not find conditions favourable for permanent breeding.

Dinger (J. E.). **Gelbfieber bei weissen Mäusen.** [Yellow Fever in White Mice.]—*Zbl. Bakt.* (1, Orig.), cxxi, no. 3–4, pp. 194–212, 4 figs., 12 refs. Jena, 24th June 1931.

A series of experiments made at Amsterdam have proved that white mice can be infected with yellow fever ; intracerebral inoculation results in 100 per cent. mortality. The disease was transmitted to monkeys (*Macacus rhesus*) by the bite of *Aëdes argenteus*, Poir., fed on an emulsion prepared from the brain of an infected mouse, and by inoculation of an emulsion of mosquitos similarly infected.

Dyer (R. E.), Badger (L. F.) & Rumreich (A.). **Rocky Mountain Spotted Fever (Eastern Type). Transmission by the American Dog Tick** (*Dermacentor variabilis*).—*Publ. Hlth. Rep.*, xlvi, no. 24, pp. 1403–1413, 7 charts, 12 refs. Washington, D.C., 12th June 1931.

In continuation of studies of a disease resembling typhus or Rocky Mountain spotted fever, occurring in the eastern part of the United States [*cf. R.A.E.*, B, xix, 155], attempts have been made to transmit it by *Dermacentor variabilis*, Say. Larvae from an engorged female of this tick that was obtained from a district where the disease occurred [*cf.* xix, 156] were fed on an infected guineapig until they became engorged. A month after they had reached the nymphal stage they were fed to engorgement on a non-infected guineapig, which became infected and died, and were then ground up and injected into fresh guineapigs. This resulted in the establishment of a strain of virus in guineapigs. Reports of histological studies of the brains of guineapigs inoculated with tick-passage virus of the eastern type of spotted fever are given. The virus of the eastern type of the fever is preserved in the body of *D. variabilis*, through at least one moult.

Hesse (E.). **Ueber den Stich von** *Hippobosca equina* **L.** [On the Bite of *H. equina*.]—*Z. wiss. InsektBiol.*, xxvi, no. 2-3, p. 79. Berlin, May 1931.

The horse fly, *Hippobosca equina*, L., is recorded as attacking man in Germany.

Schwardt (H. H.). **The Biology of** *Tabanus lineola* **Fabr.**—*Ann. Ent. Soc. Amer.*, xxiv, no. 2, pp. 409–416, 10 refs. Columbus, Ohio, June 1931.

This life-history study in Arkansas is based on observations of 202 individuals of *T. lineola*, F., reared from egg to adult, and on field studies. The technique employed in rearing them is described. The incubation period averaged 4 days, the larval 48·8 (though the variations were very great), the pupal 8·1 and the preoviposition period 9. There are at least two generations a year in Arkansas. In the field, larvae are usually found in the mud bordering lowland ponds or sluggish water courses. The pupae do not require any drier environment than the larvae ; in many instances adults have emerged normally from pupae half submerged in water. Practically

all transformations occurred on the surface of the sand provided for them. Pupae are rarely found in the field, but one was taken in the mud border of a small pond. In the insectary, oviposition was readily obtained on either rice or barnyard grass. Eggs have been taken in the field from 2nd June till 14th August on low vegetation at the water's edge.

MELVIN (R.). **Notes on the Biology of the Stable-fly,** *Stomoxys calcitrans* **Linn.**—*Ann. Ent. Soc. Amer.*, xxiv, no. 2, pp. 436–438. Columbus, Ohio, June 1931.

During an investigation which involved the rearing of large numbers of *Stomoxys calcitrans*, L., it was found that at 25° C. [77° F.] the average incubation period was 33·4 hours, and at 30° C. [86° F.] it was 26·5. The larval and pupal period of individuals bred on equal quantities (by weight) of lucerne meal and wheat bran averaged 377 hours at 25° C. and 311·7 at 30° C., and, in the case of those bred on ground oats, 320·2 hours at 30° C. in one set of tests, and 326·1 in another series. The pupal period at 100 per cent. relative humidity required 177·2 hours. At 25° C. and 73 per cent. relative humidity, only 10 per cent. of the pupae placed over a saturated solution of common salt gave rise to adults. The technique employed is described.

TARLIER (A.). **L'***Hypoderma bovis* **chez le cheval.**—Med. 8vo, 47 pp., 2 pp. refs. Paris, Vigot Frères, 1930. [Recd. July 1931.]

An account is given of the infestation of horses by *Hypoderma bovis*, DeG., with references to the observations of other authors on the occurrence of the fly in cattle and horses, and notes on its history and distribution and its bionomics in cattle.

The following is taken from the author's conclusions: *H. bovis*, which usually infests cattle, will also sometimes attack horses. Though the conditions for its development on the latter host are not favourable, the larvae usually dying before reaching maturity, a number of cases of serious injury have been recorded from North Africa. The larvae, which are difficult to locate in the body of the horse, apparently leave the digestive tract through the roof of the pharynx and enter the brain, causing paralysis and other nervous diseases. The results of the infestation usually become noticeable in late spring or early summer in horses that have been kept in pastures during the preceding summer and autumn.

Runderhorzelbestrijding. [Work against Ox Warbles.]—*Runderhorzelbestrijdings-Commissie* [Publication] no. 2, 12 pp., 11 figs. Utrecht [1931].

The larvae of *Hypoderma bovis*, DeG., and *H. lineatum*, Vill., cause considerable damage to hides in Holland, and this publication of the Cattle Warble Commission gives a brief description of the adult flies, larvae and eggs, and of the injury done. The remedy advised is a salve, "Hypodermacid," prepared commercially to a formula worked out by the Commission, which is applied to the open warbles just before the cattle are sent out to pasture. The application is repeated some time later to deal with warbles that subsequently appear. The dead larvae are left *in situ* and gradually disappear, the hide becoming quite healthy in 2–3 weeks.

Schuberg (A.). **Zur Bekämpfung der Dasselplage.** [On the Control of the Warble Pest.]—*Berl. tierärztl. Wschr.*, xlvi, no. 28, p. 448. Berlin, 1930. [Recd. June 1931.]

Experiments in Germany have shown that the liquid insecticides "Flit" and "Delicia" sprayed and rubbed on cattle infested with warble-flies [*Hypoderma*] are effective against the larvae, about 91 per cent. being killed by the former, and about 82 per cent. by the latter. These materials applied to young animals in February–April will also destroy other parasites. It is suggested that spraying alone (without rubbing) should be tried, repeated applications being made if required.

Compton (C. C.). **Extension Work in Ox Warble Control.**—*J. Econ. Ent.*, xxiv, no. 3, pp. 643–646. Geneva, N.Y., June 1931.

An account is given of the work done at classes of instruction held in northern Illinois since 1925 to acquaint dairymen with the losses inflicted by the ox warble-flies, *Hypoderma bovis*, DeG., and *H. lineatum*, Vill., on cattle and with the best known control measures. In the campaigns organised as the result of this instruction, a marked reduction of infestation was secured in cases where several herds situated in a somewhat isolated group were treated together, but where single herds were treated and the pasture adjoined that of an untreated herd, the reduction was not appreciable. One herd so situated that no other dairy animals occurred within a mile was entirely freed of warbles in three seasons, the average number of flies being reduced from 6·7 to 1·3 a head in the first year.

Experience with various dusts and ointments has shown that ointments are the most satisfactory materials for the purpose. In a widely co-operative experiment carried out in 1929 with a proprietary derris extract ointment, control operations were begun about 20th February and continued at intervals of 30 days until about 1st July. A comparison of the average number of warbles per animal under three years old in treated and untreated herds both in 1929 and 1930 showed an approximate reduction of 66 per cent. in the fly population.

Hockenyos (G. L.). **Rearing Houseflies for testing Contact Insecticides.**—*J. Econ. Ent.*, xxiv, no. 3, pp. 717–725, 4 figs., 5 refs. Geneva, N. Y., June 1931.

A technique developed from that devised by Grady [*R.A.E.*, B, xvi, 254] is described for rearing *Musca domestica*, L., for testing insecticides. It was found that a mixture of 4 parts of pig manure with 3 of horse manure is a more satisfactory breeding medium than the latter alone. Detailed descriptions are given of new and convenient types of breeding and testing cages. One type used was constructed of copper fly screen, one end of which is closed by a cloth extension with a draw string to provide a means of closing it, the diameter being such that it just fits over the breeding jar when the cloth is fully extended. The jar is two-thirds filled with the mixture, and flies of both sexes are placed in the cage which is slipped over the jar. Bread moistened with milk and sugar is placed from time to time in the jar for food. If the lower part of the cage is covered with black material, the flies will go to the top and may be removed with the cage. Various methods for regulating pupation and removal of pupae are outlined. Occasional scalding with steam controls a parasitic mite that attacks the adults

and causes a reduction in the number of larvae produced. Neither the eggs nor larvae are directly affected by it. Flies were produced out of doors by placing fresh pig manure on a coarse screen stretched over a pan 3 ft. square and 3 ins. deep. As the larvae matured on the screen, they crawled to the edge and dropped into the pan, which contained ½ in. of sifted soil in which pupation takes place. Storage tests with the material thus obtained showed the best results with pupae stored at 55° F. under which conditions 75 per cent. emergence was obtained at the end of two weeks. Storage of eggs, larvae and adults was unsatisfactory, though hatching occurred in one day's time at 50° F., and a few hatched at 37° F.

A cage, 3 ft. high and 4 ft. in diameter, for testing household sprays on flies is described. It consists of a wooden framework covered at the side and top with cellophane. Three windows large enough to admit flies and a spray nozzle are provided and closed with a fastening. A second type of cage is of the same dimensions but of open fly-screening, and with a bottom made of a piece of conical cloth fastened to a separate hoop. This cage was suspended from the ceiling by means of a pulley and counterweight. A spray chute is described for testing the delivery of various types of sprayers and pumps as well as a method for making tests on individual houseflies, and it is shown that certain contact poisons such as pyrethrum are absorbed directly through the body wall without entering the tracheae.

SHEPARD (H. H.). **The Relative Toxicity of Rotenone and Nicotine to** *Aphis rumicis* **L. and Mosquito Larvae.**—*J. Econ. Ent.*, xxiv, no. 3, pp. 725–731, 6 refs. Geneva, N.Y., June 1931.

This paper includes notes on the results of comparative tests with rotenone and nicotine against the larvae of *Culex pipiens*, L. The larvae were immersed for a given time in suspensions or solutions of these compounds and subsequently removed to distilled water in order to observe the extent of their recovery after 24 hours. The relative percentages of mortality were 10·5 and 15·5 in the case of 0·01 per cent. nicotine, and 34·5 and 76·0 in that of 0·01 per cent. rotenone, for 30-minute and 2-hour exposures respectively. The figures indicate the combined percentage of killed and paralysed larvae. No mortality was observed in the distilled water controls.

LITTLE (V. A.). **A preliminary Report on the insecticidal Properties of Devil's Shoe-string,** *Cracca virginiana* **Linn.**—*J. Econ. Ent.*, xxiv, no. 3, pp. 743–754, 11 refs. Geneva, N.Y., June 1931.

This is a more detailed account of an investigation already noticed [*R.A.E.*, B, xix, 140] in regard to the development of a fish poison for insecticidal purposes found in *Tephrosia* (*Cracca*) *virginiana* (devil's shoe-string). Aqueous suspensions of the powdered roots compare favourably in toxicity with derris, pyrethrum and nicotine sulphate (40 per cent.). The supply is at present adequate for commercial purposes, but owing to marked variations in the toxicity of the plant, it may not be possible wholly to utilise it. It will be essential to carry out extensive experimental work on the factors influencing its toxicity, growing and harvesting, and its chemical constitution, in addition to exhaustive tests on many forms of insects under both laboratory and field conditions.

RICHARDSON (H. H.). **Research on Kerosene Extracts of Pyrethrum.**—*J. Econ. Ent.*, xxiv, no. 3, pp. 763–764. Geneva, N.Y., June 1931.

Concerning the insecticidal method for the estimation of kerosene extracts of pyrethrum [*R.A.E.*, A, xix, 344], it is suggested that greater uniformity in the results may be obtained by placing treated house-flies [*Musca domestica*, L.] in a constant temperature and humidity box (75° F., 50 per cent. humidity) for the 24 hours following the application. It is also suggested that this method is applicable to the testing of water emulsions of pyrethrum extract provided that a suitable wetting agent is present in the spray.

A short summary, from which the following is taken, is given of the continuation of the paper already noticed [*loc. cit.*]. Various fractions of kerosenes were found to vary materially in their insecticidal power. A light fraction (48° Bé., 310–395° F. boiling range) was decidedly slower in its speed of paralytic action and much less toxic in its final kill than a heavier one (41° Bé., 378–516° F. boiling range). Little difference was noted in a series of three short-cut fractions between 400° to 500° F. boiling range. Kerosenes refined with liquid sulphur dioxide (Edeleanu refining process) showed little difference in toxicity from other fractions of the same boiling range. The efficiency of kerosene extraction was found to vary considerably with the degree of fineness of the powder, 90 per cent. extraction being obtained with 200-mesh powder and 75–80 per cent. with 15-, 20-, 30- and 45-mesh ones.

Tattersfield and Hobson's short acid method for the analysis of pyrethrin I [*R.A.E.*, A, xvii, 602] was found to give reproducible results, and with a series of various pyrethrum powders the pyrethrin I content was found to give a reliable index of the insecticidal power of kerosene extracts of these powders. This was also found to be true with deteriorated pyrethrum powders. Insecticidal tests showed no deterioration in extracts kept for twelve months.

Further experiments indicated that normally a considerable number of flies that had been completely paralysed by a kerosene extract of pyrethrum recover 5–15 hours after the application, and their fertility remains unaffected. Pyrethrum extract appeared to have little repellent action on *Musca domestica*. A new technique of rearing *M. domestica* was developed. Experiments indicated that the flies reared in this way were most resistant from 24 to 48 hours of age, after which their resistance decreased. The flies' resistance to the paralytic action of pyrethrum extracts, however, was least at the younger age and increased as they grew older.

PAPERS NOTICED BY TITLE ONLY.

ZUNKER (M.). **Die Mallophagen der Haustiere. II. Mitteilung.** [The Mallophaga of Domestic Animals. Second Communication. Species infesting the domestic pigeon and the turkey.]—*Arch. Tierheilk.*, lxi, pp. 344–358, 11 figs., 22 refs. Berlin, 1930.

NICOLLE (C.), ANDERSON (C.) & LE CHUITON (F.). **Sur un cas de fièvre récurrente espagnole, observé en Tunisie.**—*Arch. Inst. Pasteur Tunis*, xx, no. 1, pp. 1–20. Tunis, April 1931. [For briefer account see *R.A.E.*, B, xix, 90.]

VELU (H.), BALOZET (L.) & ZOTTNER (G.). **Contribution à l'étude expérimentale de** *Spirochaeta hispanica* (**var.** *marocana*) [as studied in animals].—*Arch. Inst. Pasteur Tunis*, xx, no. 1, pp. 21–47, numerous refs. Tunis, April 1931. [*Cf. R.A.E.*, B, xviii, 103.]

DURAND (P.) & CONSEIL (E.). **Transmission expérimentale de la fièvre boutonneuse par** *Rhipicephalus sanguineus*.—*Arch. Inst. Pasteur Tunis*, xx, no. 1, pp. 54–55. Tunis, April 1931. [*Cf. R.A.E.*, B, xviii, 189.]

DURAND (P.). *Rhipicephalus sanguineus* **et virus de la fièvre boutonneuse de Tunisie.**—*Arch. Inst. Pasteur Tunis*, xx, no. 1, pp. 56–58, 3 refs. Tunis, April 1931. [*Cf. R.A.E.*, B, xix, 137.]

WASSILIEFF (A.). **Les rongeurs et puces de la Tunisie et leur rôle dans la propagation de la peste. I. Note préliminaire sur les puces de la Tunisie.**—*Arch. Inst. Pasteur Tunis*, xx, no. 1, pp. 59–65, 1 map. Tunis, April 1931.

ROUBAUD (E.). **Fatigue évolutive cyclique et lignées infatigables chez la mouche verte commune** *Lucilia sericata* **Meig.**—*C.R. Acad. Sci. Fr.*, cxciii, no. 3, pp. 204–205, 1 ref. Paris, 1931.

GOFFE (E. R.). **British Tabanidae (Diptera), with an Account of the principal Variation. With Descriptions of a Number of new Forms, and of some Additions to the British List.**—*Trans. Ent. Soc. S. England*, no. 6 (1930), pp. 43–114, 2 pls., 4 pp. refs. Southampton, 8th August 1931.

BLANC (C.) & CAMINOPÉTROS (J.). **Le virus de la fièvre boutonneuse (fièvre exanthématique) provenant du sang de malades ou de l'organisme de la tique est filtrable.**—*C.R. Acad. Sci. Fr.*, cxcii, no. 23, pp. 1504–1505, 2 refs. Paris, 1931.

BLANC (G.) & CAMINOPÉTROS (J.). **Le virus de la fièvre boutonneuse est héréditaire chez la tique** *Rhipicephalus sanguineus*.—*C.R. Acad. Sci. Fr.*, cxcii, no. 25, pp. 1682–1684. Paris, 1931.

TROISIER (J.) & CATTAN (R.). **Fièvre exanthématique inapparente de l'homme provoquée par** *Rhipicephalus sanguineus*. **Sa virulence pour le singe et le cobaye.**—*C.R. Acad. Sci. Fr.*, cxciii, no. 1, pp. 91–93. Paris, 1931.

KRÖBER (O.). **Neue Arten der Gattung** *Fidena* **Walk. (Dipt. Tabanidae).** [21 new species from South America.]—*Zool. Anz.*, xcv, no. 1–2, pp. 17–37, 19 figs. Leipzig, 15th June 1931.

KEMPER (H.). **Beiträge zur Biologie der Bettwanze** (*Cimex lectularius* **L.**). **ii. Ueber die Häutung.** [Contributions to the Biology of *C. lectularius*. ii. Moulting.]—*Z. Morph. Oekol. Tiere*, xx, no. 1, pp. 53–109, 9 figs., 33 refs. Berlin, 11th June 1931.

IMES (M.). **Hog Lice and Hog Mange. Methods of Control and Eradication.**—*Fmrs.' Bull. U.S. Dept. Agric.*, no. 1085, revd. edn., 22 pp., 10 figs. Washington, D.C., February 1931. [*Cf. R.A.E.*, B, viii, 200; xii, 49.]

HOARE (C. A.). **The Peritrophic Membrane of** *Glossina* **and its bearing upon the Life-cycle of** *Trypanosoma grayi*.—*Trans. R. Soc. Trop. Med. Hyg.*, xxv, no. 1, pp. 57–64, 2 figs., 9 refs. London, 30th June 1931.

PHILIP (C. B.). **Two new species of** *Uranotaenia* **(Culicidae) from Nigeria, with Notes on the Genus in the Ethiopian Region** [including a key to the adults and described larvae and pupae].—*Bull. Ent. Res.*, xxii, pt. 2, pp. 183–193, 2 figs., 19 refs. London, June 1931.

DE MEILLON (B.). **A new Species of** *Forcipomyia* [*randensis*, sp. n.] **(Diptera, Ceratopogonidae) from the Transvaal, with a Description of its early Stages.**—*Trans. Ent. Soc. Lond.*, lxxix, pt. 2, pp. 335–340, 17 figs., 1 ref. London, 10th July 1931.

NIESCHULZ (O.). **Ueber Darmflagellaten von Tabaniden in Java.** [On the Flagellates of the Gut of Tabanids from Java.]—*Z. Parasitenk.*, iii, no. 2, pp. 267–268. Berlin, 20th April 1931.

[Bolduirev (T. E.).] **Болдырев (Т. Е.). "NCJ" and its insecticidal Properties.** [*In Russian.*]—*Rev. Microbiol.*, x, no. 1, pp. 41–57, 5 refs. Saratov, 1931. (With a Summary in German.)

This is a detailed account of laboratory investigations on the value of a mixture of naphthalene, creosote and iodoform in the control of *Pediculus humanus*, L., with a view to its use in the army in war time. The physico-chemical properties of the mixture are discussed, and the method of preparing it is described, the proportion recommended being 94 parts of naphthalene to 3 parts each of the other two substances. In the laboratory, lice placed in a covered dish containing 1 gm. of the dry mixture were killed in an average of 10–18 minutes at a temperature of 15° C. [59° F.], the larvae being more resistant than the adults, and fleas and bugs [*Cimex*] in 5–8 and 30–45 minutes respectively. Its toxicity was found to increase at higher temperatures, adult lice and larvae being killed in 5–6 and 6–8 minutes respectively at 35° C. [95° F.]. In the case of eggs, its effectiveness varied directly with the duration of exposure, 100 per cent. mortality being obtained in an hour at 15° C., as compared with 20 and 30 per cent. in 15 and 20 minutes respectively; at 37° C. [98·6° F.] the rate of mortality was 50 and 60 per cent. in 15 and 20 minutes respectively. When left exposed to the air at 20° C. [68° F.], the mixture preserved its insecticidal properties for ten days, after which it became less effective, a considerably longer exposure of the insects to the vapour being necessary in order to kill them. Special experiments, the results of which are given in a table, showed that the vapour easily penetrates one or more layers of the different fabrics that are used in army uniforms, without losing its insecticidal power or damaging them. In a sufficiently tightly closed space lice are killed at a distance of 10 ins. The application of 5 per cent. solutions of the material in xylol or kerosene killed all adult lice in 20–25 seconds, and the eggs in one minute, and 10 and 5 per cent. solutions in benzene killed all the adults in 20 and 35–40 seconds respectively.

The laboratory observations were confirmed by experiments on man, which are described. Bands attached to different parts of the body, or to the underclothing, and containing a total of 10–20 gm. of the dry material had chiefly a repellent effect on the lice, causing them to abandon the host and killing only a few. This measure would not, therefore, prevent the spread of infestation under the crowded conditions of barracks, etc., or where the lice are abundant, but it may be of value, if the dose is increased to 50 gm. [1·75 oz.] per person. Soaking infested clothing in 5 per cent. solutions of the mixture in xylol, kerosene or benzene rapidly killed all the lice and eggs and prevented reinfestation for at least five days, after which the clothing was treated again. Under field conditions it is more advantageous to apply the solution in benzene, as clothing thus treated quickly dries and does not require airing.

[Gaĭskiĭ (N.).] **Гайский (Н.). A new Carrier of Plague**—*Ellobius talpinus*, **Pall.** [*In Russian.*]—*Rev. Microbiol.*, x, no. 1, pp. 59–61. Saratov, 1931. (With a Summary in French.)

During investigations on plague carried out in June 1928 in a district situated between the lower Volga and Ural rivers, where an epizootic occurred among ground squirrels [*Citellus pygmaeus*], four individuals

of *Ellobius talpinus* were found dead in their burrows. Examination of one of these rodents revealed the presence of numerous plague bacilli, and a guineapig was infected from them and died of plague on the fourth day. *Rhipicephalus schulzei*, Ol., was found in their nests, and of the fleas collected, 90 per cent. were *Xenopsylla mycerini*, Roths., other species being *Ctenophthalmus breviatus*, Wagn. & Ioff, *C. pollex*, Wagn., *Ceratophyllus tesquorum*, Wagn., and *Neopsylla setosa*, Wagn. The character of the area is briefly described. *E. talpinus* occurs in the low-lying places of the steppe, to which the scanty population is attracted by the presence of drinking water and suitable agricultural land.

[KALINA (G. P.).] **Калина (Г. П.). The Biology of Marmots of southern Kirghiziya and their epidemiological Importance.** [*In Russian.*]—*Rev. Microbiol.*, x, no. 1, pp. 69–82, 1 fig. Saratov, 1931. (With a Summary in German.)

In view of the fact that *Marmota* (*Arctomys*) *centralis* plays an important part in the spread of plague in the Naruin district in the south of the Kirghiz Republic, a special expedition was organised in 1929 to study the biology of the marmot (*M.* (*A.*) *caudata*) that occurs in an adjoining district to the south-west. Numerous fleas were taken on live and dead animals and in their nests, but owing to an accident during transport most of the collection was lost ; all the remaining fleas, except one individual of *Ceratophyllus* sp., were *Pulex irritans*, L. The fleas remained on their hosts in captivity, even if the latter were kept in sacks, but soon abandoned those that became dormant or died, though sometimes they were present on the body of the host for 24 hours after it had died. In one instance two fleas were even found in the fur of a marmot skin that was drying after having been treated with salt. The fleas readily migrated to and attacked man, field-mice and guineapigs. Some of the marmots harboured the nymphs of a tick of the genus *Hyalomma*.

[STEPANOV (I. V.).] **Степанов (И. В.). Rats and Mice of the Town of Batum.** [*In Russian.*]—*Rev. Microbiol.*, x, no. 1, pp. 83–92, 2 graphs. Saratov, 1931. (With a Summary in French.)

Details are given of the numbers of each species of flea found on rats and mice examined for the presence of plague in Batum during a period of 3 years ending 1st July 1930. Of 14,097 fleas collected from *Mus* (*Rattus*) *norvegicus*, which was the commonest species, and *M.* (*R.*) *rattus* and *M.* (*R.*) *alexandrinus*, which were rare, 64·3 per cent. were *Leptopsylla segnis*, Schönh. (*musculi*, Dug.), 20·5 per cent. *Xenopsylla cheopis*, Roths., 13·9 per cent. *Ceratophyllus fasciatus*, Bosc, and 1·3 per cent. *Ctenocephalides* (*Ctenocephalus*) *felis*, Bch., and *C.* (*C.*) *canis*, Curt. The curve of percentage prevalence of *L. segnis* corresponds closely to that of the humidity, this species being especially abundant in October-November and again in February. The numbers of *X. cheopis* varied during the year, depending both on temperature and the rate of humidity, being highest in July, and August–September, when it constituted over 50 per cent. of all the fleas. The average flea index was 3·2 per rat, but as most of the examined animals were dead and a considerable number of fleas had probably abandoned them, the index must be higher under natural conditions.

The number of fleas found on mice, all of which were *Mus musculus*, was less than one-tenth that on rats, the average flea index being 0·32 per mouse. Of 672 fleas, 83·7 per cent. were *L. segnis*, 9·8 per cent. *C. fasciatus* and 6·5 per cent. *X. cheopis*, their seasonal occurrence on mice being the same as on rats.

Though none of the 4,451 rats and 2,075 mice examined was infected with plague, the high average flea index, which in July 1929 reached 8·3 fleas per rat, and the prevalence of *X. cheopis* in the summer provide favourable conditions for the development of a plague epizootic. Attention is drawn to the fact that one of the epidemics of human plague that have occurred in Batum coincided with an epizootic among the rats.

Günther (G.). **Die Wirkung verschiedener Antiparasitica auf Fliegenlarven.** [The Action of various Insecticides on Fly Larvae.]—*Wien. tierärztl. Mschr.*, xvii, no. 21, pp. 813–816. Vienna, 1st November 1930. [Recd. June 1931.]

An account is given of experiments with numerous substances against the larvae of *Calliphora* (*Musca*) *vomitoria*, L., and *Musca domestica*, L. They were caused to cover themselves with a paste prepared by drying and grinding cow-dung, which was then wetted with the chemical under test. A form of creolin proved to be the only one of value, and none was found that was odourless and cheap.

Stiles (G. W.). **Anaplasmosis in Cattle.**—*Circ. U.S. Dept. Agric.*, no. 154, 10 pp., 4 figs. Washington, D.C., February 1931. [Recd. June 1931.]

An account is given of anaplasmosis in cattle in the United States, where sometimes as many as 40 per cent. of the animals are affected. Seven species of ticks have been proved capable of transmitting the disease under experimental conditions in other parts of the world, and *Rhipicephalus sanguineus*, Latr., has recently been shown to do so in the United States [*R.A.E.*, B, xix, 66]. Further research into the possibility of transmission by other Arthropods is desirable.

Mazza (S.), Romaña (C.) & Schürmann (K.). **Nuevas observaciones sobre la infección espontánea de armadillos del país por el** *Trypanosoma cruzi*. [New Observations on the natural Infection of Argentine Armadillos by *T. cruzi*].—*Prensa méd. argent.*, 28th February 1931, reprint 20 pp., 8 figs., 12 refs. Buenos Aires, 1931.

Trypanosoma cruzi has been found in the armadillos, *Chaetophractus vellerosus* and *Dasypus novemcinctus*, in Argentina.

Bedford (G. A. H.). **The Ectoparasites of Mammals and Birds and their Importance.**—*Pamph. S. Afr. Biol. Soc.*, no. 2, 6 pp. Pretoria, 1931.

In this somewhat popular paper, the author discusses the natural relationships of certain Anoplura and Mallaphoga, and cites several examples demonstrating the important light these ectoparasites throw on the phylogeny of their hosts.

Nieschulz (O.). **Een vliegenvrije ruimte voor overbrengingsproeven met bloedzuigende insecten.** [A Fly-proof Chamber for Transmission Experiments with Blood-sucking Insects.]—*Tijdschr. Diergeneesk.*, lviii, no. 3, reprint 5 pp., 3 figs. The Hague, 1931. (With Summaries in German, English and French.)

This chamber consists of a wooden frame covered with wire gauze of 2 mm. mesh, and comprises a work-room and an entrance passage. The room itself measures 6 ft. long, 6 ft. wide, and 6 ft. 8 ins. high. For experiments with micro-organisms pathogenic to man a small fly-cage of glass is used, sleeves of cotton fabric in the sides of which enable the operator to introduce his hands.

Esdaile (P. C.). **Economic Biology for Students of Social Science. Part II. Animal and Vegetable Products.**—Demy 8vo, xv+231 pp., 96 figs. London, Univ. Press Ltd., 1931. Price 10*s*. 6*d*. net.

In the second part of this work [*cf. R.A.E.*, B, xv, 179], dealing with products of animal and vegetable origin, the insects discussed include the warble flies (*Hypoderma* spp.), with notes on the economic losses that they cause in hides and skins, and bees, Coccids and other insects concerned with the production of wax.

Frongia (G.). **Alcune osservazioni sull'anofelismo e malaria nelle risaie del Novarese.** [Some Observations on Anophelines and Malaria in the Rice-fields of Novara.]—*Il Policlinico*, xxxviii, no. 28, p. 1009. Rome, July 1931. (Abstract in *Bull. Inst. Pasteur*, xxix, no. 17, p. 841. Paris, 15th September 1931.)

Rice cultivation has developed considerably in the province of Novara, North Italy, and malaria has diminished. Anophelines are numerous, 94 per cent. being *Anopheles maculipennis*, Mg., 4 per cent. *A. superpictus*, Grassi, and 2 per cent. *A. hyrcanus* var. *pseudopictus*, Grassi. The author is of the opinion that adults developing from larvae in the rice-fields are not able to transmit malaria to man ; he failed to infect Anophelines by feeding them on malaria cases.

Bose (K.). **Mosquito Survey at Birnagar.**—*Rec. Malaria Surv. India*, ii, no. 2, pp. 193–224, 2 pls., 8 refs. Calcutta, June 1931.

A detailed account is given of an Anopheline survey of the Municipality of Birnagar (Bengal), carried out during the three years April 1927 to March 1930. The species found were: *Anopheles fuliginosus*, Giles, *A. pallidus*, Theo., *A. philippinensis*, Ludl., *A. aconitus*, Dön., *A. ramsayi*, Covell, and *A. tessellatus*, Theo., as well as those already recorded from this area [*R.A.E.*, B, xiv, 221 ; xvi, 7], with the exception of *A. listoni*, List. (*fluviatilis*, James) and *A. jamesi*, Theo. *A. philippinensis* is the principal carrier of malaria, although *A. fuliginosus* and *A. pallidus* have also been found infected in nature. Discrepancies regarding the adult habits and relation to malaria of *A. philippinensis* in Assam and Bengal are discussed. As a result of the survey, a campaign directed against the breeding-places of this species has been substituted for the general anti-larval measures that had previously proved unsuccessful.

Barraud (P. J.) & Christophers (S. R.). **On a Collection of Anopheline and Culicine Mosquitoes from Siam.**—*Rec. Malaria Surv. India*, ii, no. 2, pp. 269–285, 11 refs. Calcutta, June 1931.

As a result of the examination of mosquitos collected in Siam by J. A. Sinton, the information previously recorded from that country is summarised and revised. With regard to the records of Anophelines given by M. E. Barnes [*R.A.E.*, B, xi, 205], *Anopheles funestus*, Giles, is *A. listoni*, List.; *A. subpictus*, Grassi (*rossi*, Giles) undoubtedly comprised *A. vagus*, Dön., and *A. subpictus* var. *malayensis*, Hacker; *A. punctulatus*, Dön., is *A. tessellatus*, Theo.; the form of *A. hyrcanus*, Pall., appears to be var. *nigerrimus*, Giles; *A. willmori*, James, probably relates to heavily scaled individuals of *A. maculatus*, Theo.; *A. maculipalpis*, Giles, is *A. maculipalpis* var. *splendidus*, Koidz. (*indiensis*, Theo.) and *A. jamesi*, Theo., is almost certainly *A. ramsayi*, Covell, a specimen of which was also collected by Sinton. The synonymy and identification of some of the Anophelines recorded in a list of mosquitos from Bangkok that was given in a paper by A. T. Stanton [viii, 113] are discussed; they include *A. philippinensis*, Ludl. (*fuliginosus* var. *nivipes*, Theo.). Sinton's collection includes *A. pallidus*, Theo. Among the numerous Culicines dealt with is *Culex tritaeniorhynchus* var. *siamensis*, n.

Christophers (S. R.). **Studies on the Anopheline Fauna of India (Parts I-IV).**—*Rec. Malaria Surv. India*, ii, no. 2, pp. 305–332, 3 maps, 24 refs. Calcutta, June 1931.

The following is largely taken from the author's summaries. In the first paper, which deals with the Anopheline fauna of Kashmir, the following species are recorded: *Anopheles barianensis*, James, *A. lindesayi*, Giles, *A. gigas* var. *simlensis*, James, *A. listoni*, List., *A. fuliginosus*, Giles, *A. maculipalpis* var. *splendidus*, Koidz. (*indiensis*, Theo.) and *A. maculatus* var. *willmori*, James.

The second paper deals with the Anopheline fauna of North-west India north of latitude 30° N. The fauna of the Punjab Hill Tract is montane and alpine Oriental in character as it extends across the Indus north of the Kabul river, but south of the river there is a rapidly increasing admixture of Mediterranean species, *viz.*, *A. superpictus*, Grassi, *A. dthali*, Patton, *A. multicolor*, Camb., and *A. sergenti*, Theo., until in Baluchistan these are predominant. The alpine species are *A. gigas* var. *simlensis*, *A. lindesayi* and *A. barianensis*. The Oriental element in the fauna of the plains of this area is already impoverished, as compared with the much larger number of species encountered further east, even in the Indian Sub-region. On the other hand *A. subpictus*, Grassi, and *A. fuliginosus* extend up to the Suleiman Range and Himalayas, beyond which, however, they have not been recorded. The other Oriental species found in this region are *A. hyrcanus* var. *nigerrimus*, Giles, *A. barbirostris*, Wulp, *A. maculipalpis*, Giles, *A. maculatus*, Theo., *A. maculatus* var. *willmori*, *A. pallidus*, Theo., and *A. theobaldi*, Giles. The Western Oriental or Indian element, represented by the species *A. turkhudi*, List., *A. moghulensis*, Chr., *A. listoni*, *A. culicifacies*, Giles, *A. stephensi*, List., and, to a less extent, *A. pulcherrimus*, Theo., is dominant throughout the whole area except where alpine conditions prevail. As a rule these species continue their distribution westwards to other countries beyond the mountain barriers.

In the third paper the varietal forms of *A. gigas*, Giles (including var. *refutans*, Alcock, var. *formosus*, Ludl., var. *baileyi*, Edw., and var. *simlensis*) and of *A. lindesayi* (var. *japonicus*, Yam., var. *pleccau*, Koidz., var. *cameronensis*, Edw., and var. *nilgiricus*, Chr.) are discussed with keys. The characters distinguishing *A. gigas* from *A. edwardsi*, Yam., are given. The form of *A. gigas* occurring in the Eastern Himalayas, Assam Hills and Burma appears invariably to be var. *baileyi* as contrasted with var. *simlensis* in the north-west.

In the fourth paper the variation shown by *A. maculatus* is described. The position regarding the geographical forms appears to be that the typical form (of which *A. maculatus* var. *dravidicus*, Chr., and *A. hanabusai*, Yam., are considered to be synonyms,) with a very variable degree of scaling but with scales at least on the last two or three segments, is distributed throughout China, the Philippines, Indo-China Siam, Burma and Peninsular India, and Ceylon, and that an almost scaleless form (*pseudowillmori*, Theo.) with scales confined to the eighth segment, very narrow and mixed with hairs, occurs along the submontane region of the Himalayas. *A. maculatus* var. *willmori*, with consistently heavy abdominal scaling, and, towards the east, with a large proportion of individuals showing maculation of the palps (var. *maculosa*, James & List.), is distributed along the whole Himalayan Range as a montane species at altitudes between 2,000 and 8,000 ft. *A. theobaldi* is a closely related species that on present evidence is considered distinct.

BUTT (N. M.). **A simple and inexpensive portable Screener for use with Paris Green Diluents.**—*Rec. Malaria Surv. India*, ii, no. 2, pp. 333–335, 4 figs. Calcutta, June 1931.

A description is given of an apparatus for sifting dusts used as diluents for Paris green. It consists essentially of two trays fixed one above the other, the upper one having a bottom of galvanised iron gauze (mesh 12 to the linear inch) and the lower one a bottom of copper or brass wire gauze (mesh 40 to the linear inch). The material to be screened is placed in the upper tray, and the apparatus is worked by shaking from side to side. The advantages of this type of screener over that usually employed (a box on legs and containing two concentric wire gauze cylinders rotated by hand) are that it is cheaper to make, more easily transported and less likely to get out of order; moreover, as it resembles the sieve used in Indian villages for sifting flour, the average native of that country finds no difficulty in using it.

STRICKLAND (C.) & ROY (D. N.). **The Value of the "Sergents' Method" for detecting malarial Infection in mosquitoes.**—*Ind. Med. Gaz.*, lxvi, no. 7, pp. 388–390, 2 figs., 5 refs. Calcutta, July 1931.

A brief description is given of the Sergents' method of detecting sporozoites of malaria in Anopheline mosquitos, and of the slight modifications used by the authors. The accuracy of the modified method was tested by using it to examine females of *Anopheles stephensi*, List., for parasites and checking the result by dissecting out the salivary glands as in the old method. In every case when the salivary glands were found to be infected, sporozoites had already been observed in the haemocoelic fluid, and in no case when the haemocoelic

fluid was found to be infected were sporozoites absent from the salivary glands. This method is much more rapid and requires much less skill.

ANAZAWA (K.). **Experimental Studies on the Susceptibility to Infection of Anopheline Mosquitos of Formosa.** [*In Japanese.*]—*J. Med. Ass. Formosa*, xxx, pp. 269–285, 381–393, 531–542, 609–632. Taihoku, 1931. (With a Summary in English.)

Experiments on the susceptibility of various Anophelines to infection with malaria were carried out at a temperature of over 20° C. [68° F.] and a humidity of over 63 per cent. *Anopheles ludlowi*, Theo. (*hatorii*, Koidz.), *A. maculipalpis* var. *splendidus*, Koidz., and *A. lindesayi* var. *pleccau*, Koidz., were all found to be susceptible to malignant tertian [*Plasmodium falciparum*], benign tertian [*P. vivax*,] and quartan [*P. malariae*], and *A. tessellatus*, Theo., and *A. fuliginosus*, Giles, to the last two. *A. minimus*, Theo., and *A. maculatus*, Theo., were both positive to *P. malariae*, and *A. maculatus* particularly so to *P. vivax*. *A. hyrcanus* var. *sinensis*, Wied., was negative in experiments with *P. falciparum*.

BISHOP (S. C.) & HART (R. C.). **Note on a Migration of Mosquito Larvae.**—*Bull. Brooklyn Ent. Soc.*, xxvi, no. 2, pp. 88, 90. Brooklyn, N.Y., April 1931.

It is estimated that about 700,000 acres of the San Luis Valley, Colorado, are under irrigation, the flooding of which creates ideal breeding-places for mosquitos each spring. Many of the roads are bordered by ditches or borrow-pits that have no connection with the drainage or irrigation systems and are filled by seepage from the adjacent meadows. Frequently the water level in the ditch attains that of the meadows, and communication between the two is established at intervals. In such a ditch local migration of mosquito larvae had been observed as the larvae moved from the deeper sections to the warmer grass-grown edges, and at a time when most of the larvae were full-grown, they were seen to move uniformly in the direction that would lead them to the open waters of the meadow. There was no perceptible general movement of the water, and the surface was moved slowly by a light wind in the direction opposite to that taken by the larvae. They continued to migrate until they had travelled the entire length of the ditch (about 200 yards) or until they had reached the place where the water spread out to join that of the meadow. When the ditch was examined on the following day, only a few pupae were found. The majority of the larvae involved in the migration were those of *Aëdes dorsalis*, Mg.

DAUBNEY (R.) & HUDSON (J. R.). **Enzootic Hepatitis or Rift Valley Fever. An undescribed Virus Disease of Sheep, Cattle and Man from East Africa. With an Account of an experimental Inoculation of Man by P. C. Garnham.**—*J. Path. Bact.*, xxxiv, no. 4, pp. 545–579, 3 pls., 12 refs. London, July 1931.

A very detailed account is given of a hitherto unknown virus disease, an outbreak of which in sheep was studied in 1930 in the Rift Valley of Kenya Colony. It is named enzootic hepatitis or Rift Valley fever, and has undoubtedly existed in this valley for some years, being

responsible for extensive losses in sheep and lambs. Abortions and heavy mortality of adult and young sheep have been specially noticeable in wet years, and in each case there has been a history of abortion of cattle and of a dengue-like fever in man at the same time.

The most susceptible animal is the newly born lamb, though in experiments sheep of all breeds and ages proved liable to infection provided that they came from districts where the disease was unknown. The death-rate in newly born lambs experimentally infected was over 90 per cent., and this figure would probably hold for natural infections. The only goat inoculated with the virus gave a reaction, identical with that shown by sheep, and recovered. No outbreaks have been reported in goats, though abortions have occurred in an infected area. Cattle are susceptible, and a natural outbreak was observed in a dairy herd between 50 and 60 miles from the first outbreak in sheep. All four Europeans engaged in the investigation developed a dengue-like fever, which is described, and almost every native engaged in herding sheep during the original outbreak had been ill. Experimental inoculation of the virus from a lamb into man produced similar symptoms, and the human serum during the first six days after the commencement of the fever proved infective for lambs or sheep, but produced no reactions after that time.

Various experiments are described that indicate that the disease is not transmitted directly from animal to animal. Six sheep kept continuously under mosquito nets for five weeks all escaped infection ; of five similarly protected only at night one was infected, and of eight kept always in the open six were infected. It was thus concluded that transmission is probably effected by an insect that is excluded by a mosquito net and that feeds chiefly at night. Mosquitos were numerous in the valley, but were rarely seen on the higher pastures, and the outbreak was apparently successfully checked in flocks driven from the lower to the higher altitudes. The majority of the mosquitos in the valley proved to be one or more species of *Culex*, and *Anopheles squamosus*, Theo., *A. mauritianus*, Grp., and a species of *Mansonia* (*Taeniorhynchus*) were taken in small numbers. Inoculations of many hundred *Culex* and the few available examples of the other species produced no infection, except in the case of a lamb, known to have been previously uninfected, and inoculated with an emulsion of five specimens of the *Mansonia*, three of which were rather decomposed. This animal showed no temperature reactions, but was subsequently found to be immune.

The clinical resemblance of the disease in man to true dengue is of interest when considered with the agreement histologically between the liver lesion in sheep affected with enzootic hepatitis and that found in yellow fever in man. If *Mansonia* is the vector, it is additional evidence of the relationship of the viruses, especially as *M.* (*T.*) *africana*, Theo., can transmit yellow fever under experimental conditions [*R.A.E.*, B, xviii, 147]. These three diseases therefore seem to fall into a natural group.

McNeel (T. E.). **A Method for Locating the Larvae of the Mosquito,** *Mansonia.—Science*, lxxiv, no. 1920, p. 155. New York, N.Y., 7th August 1931.

The method found most satisfactory in Florida for determining whether a marsh is a breeding-place of *Mansonia perturbans*, Wlk.,

was to pull out the plants over about a square yard and immediately scoop up the débris to a depth of an inch, by means of a vessel with a 20 mesh screened bottom. The contents were then placed in a similarly screened conical wire basket, partly submerged, and shaken to wash out the mud. The material was then washed and examined for larvae by putting a handful in a white enamelled pan containing clear water.

MATHESON (R.) & HINMAN (E. H.). **Further Work on *Chara* spp. and other biological Notes on Culicidae (Mosquitoes).**—*Amer. J. Hyg.*, xiv, no. 1, pp. 99–108, 5 refs. Baltimore, Md., July 1931.

During 1930 further work [*cf. R.A.E.*, B, xvi, 141; xvii, 214; xviii, 108] was carried out at Ithaca, New York, in an effort to elucidate some obscure points in connection with the effects of *Chara* spp. on mosquito development. The following is taken largely from the authors' conclusions: The experiments, which are described, indicate that species of *Chara* (*C. vulgaris*, which was previously identified as *C. fragilis*, *C. delicatula*, *C. contraria* and two unidentified species) have a markedly unfavourable effect on the development of mosquito larvae, which appears to be due to the excessive amount of oxygen given off in tiny bubbles during photosynthetic activity. These bubbles are either swallowed by the larvae, causing death; or become entangled in their mouth brushes, body hairs, etc., and so interfere with their normal activities that death ensues. In experiments designed to test the effect of oxygen, it was demonstrated that the continual passage of minute bubbles of oxygen through water causes the death of mosquito larvae. In one experiment larvae reached maturity in cultures of *Chara* grown in the dark, although larvae placed with the same species of *Chara* grown in the sunlight all died. Larvae of *Aëdes stimulans*, Wlk., *Culex pipiens*, L., and *C. territans*, Wlk., were successfully reared to maturity in Berkefeld-filtered water from wooden tubs, from woodland pools, from wooden tubs to which milk had been added, from ordinary tap-water and from ponds in which *Chara* was growing. Where the bacterial contamination was comparatively low, the rate of development was nearly normal, but where it was excessive, the rate was greatly retarded. Bacteria do not, therefore, seem to be essential as a larval food. A brown species of *Hydra* was found to be an effective natural enemy of the larvae, being able to ingest practically mature individuals.

DAVIS (G. E.) & PHILIP (C. B.). **The Identification of the Blood-meal in West African Mosquitoes by means of the Precipitin Test. A preliminary Report.**—*Amer. J. Hyg.*, xiv, no. 1, pp. 130–141, 17 refs. Baltimore, Md., July 1931.

The following is largely taken from the authors' summary: In connection with studies on potential mosquito vectors of yellow fever in West Africa, it was considered of importance to obtain information concerning species feeding on man under natural conditions. Preliminary precipitin tests are reported in this paper on 864 blood samples from 26 species of Nigerian mosquitos representing 7 genera. All were tested with anti-human and anti-chicken sera, the latter being used as a check since fowls are the most common form of domestic stock. A number of tests were also made for blood of other domestic animals and birds. Two important house-frequenting mosquitos, *Mansonia* (*Taeniorhynchus*) *africana*, Theo., and *Anopheles gambiae*, Giles, gave

positive results only for human blood (195 of 210 and 154 of 188 respectively). *Culex nebulosus*, Theo., a common domestic-breeding species, was positive only for chicken blood (38 of 50).

Aëdes argenteus, Poir. (*aegypti*, auct.), *A. irritans*, Theo., *A. nigricephalus*, Theo., *A. africanus*, Theo., *A. punctothoracis*, Theo., *A. lineatopennis*, Ludl., *A. palpalis*, Newst., and *A. punctocostalis*, Theo., all gave occasional positive results for human blood, and the first three also gave occasional positive results for chicken blood. Other species that gave positive results for human blood were *Anopheles pharoensis*, Theo., *A. funestus*, Giles, *Culex thalassius*, Theo., and unidentified mosquitos resembling *C. grahami*, Theo., but possibly belonging to more than one species. The last-named group, *C. rima*, Theo., *C. decens*, Theo., *Mansonia* (*Taeniorhynchus*) *annetti*, Theo., and *Uranotaenia annulata*, Theo., gave occasional reactions for chicken blood. It is significant that no cross-reactions were observed, indicating the absence of interrupted feeding on more than one species of host.

The technique followed in collecting and testing blood samples is described, and the environmental conditions under which the mosquitos were taken are tabulated.

Frobisher, jr. (M.), Davis (N. C.) & Shannon (R. C.). **On the Failure of Yellow Fever Virus to persist in a Colony of** *Aëdes aegypti*.—*Amer. J. Hyg.*, xiv, no. 1, pp. 142–146, 4 refs. Baltimore, Md., July 1931.

The results of recent experiments by other workers [*R.A.E.*, B, xvii, 213, 237] make it appear possible that by contaminative means and sexual transmission the virus of yellow fever might be propagated among mosquitos in nature without the necessity of its passage through a mammalian host. An experiment was therefore carried out to test this hypothesis. Males of *Aëdes argenteus*, Poir. (*aegypti*, auct.) were placed with infected females in a breeding cage into which uninfected monkeys (*Macacus rhesus*) were introduced every fortnight. New mosquitos bred from eggs laid in the cage were added at intervals. The colony remained infective for at least 12 weeks, at which time the original mosquitos were about 104 days old. After 16 weeks (112 days) infectivity had died out, the relation in time between its disappearance and the usual length of life of fed mosquitos suggesting that the original stock of infected insects had died. It seems practically certain that in nature yellow fever is not self-propagated among individuals of *A. argenteus* and that these mosquitos could not maintain infective quantities of yellow fever virus without the intervention of some suitable mammalian host.

Manwell (R. D.) & Johnson (C. M.). **A natural Trypanosome of the Canary.**—*Amer. J. Hyg.*, xiv, no. 1, pp. 231–234, 9 refs. Baltimore, Md., July 1931.

Observations are reported from Pennsylvania on sixteen cases of natural infection of canaries with a trypanosome morphologically resembling *Trypanosoma paddae* and *T. gallinarum*. In a further case, infection followed intraperitoneal injection of an emulsion of mites (*Dermanyssus gallinae*, DeG.) taken from the cages of birds known to be infected with trypanosomes. Mites from such cages were examined, and in one case intermediate stages of the trypanosome were

found. This is the first record of such an infection in the Western Hemisphere, and the results reported tend to confirm those of MacFie and Thompson [*R.A.E.*, B, xviii, 23] in suggesting that *D. gallinae* is the vector of the disease.

TAMPI (M. K.). **A Study of Filariasis in Porto Rico.**—*Porto Rico J. Publ. Hlth. Trop. Med.*, vi, no. 4, pp. 435–441, 6 refs. San Juan, P.R., June 1931.

The history of filariasis in Porto Rico is briefly outlined, and an account is given of a short investigation of the present aspect of the problem, based on the results obtained by previous workers [*R.A.E.*, B, xvii, 115]. A small area known to be heavily infected was selected for study. Out of a total of 518 persons examined 7·7 per cent. were positive for *Filaria* (*Wucheria*) *bancrofti*, the highest incidence being in a boys' school where 9·5 per cent. were positive. Out of 572 mosquitos examined, only *Culex fatigans*, Wied. (*quinquefasciatus*, Say), which represented 543 of the total, was found to be infected with the larvae of *F. bancrofti*, and complete development of the larvae was seen in most of the infected specimens. Only 5·4 per cent. of the total number of *C. fatigans* were found to be infected, with a maximum rate of 7·4 per cent. in the school. Extensive potential breeding-places for mosquitos were found in the neighbourhood of the school.

Although filariasis is not a major public health problem in Porto Rico, control measures are recommended for centres of heavy infection. These would involve a filarial survey to determine such centres, definition of intermediate hosts and anti-mosquito measures.

NÖLLER (W.). **Die nächsten Verwandten der Blutflagellaten und ihre Beziehungen zu den blutbewohnenden Formen.** [The Nearest Relatives of the Blood Flagellates and their Connections with the Blood Forms.]—*Handb. path. Protoz.* (Prowazek & Nöller), iii, Lief. 13, pp. 1969–2143, 28 figs., 41 pp. refs. Leipzig, J. A. Barth, 1931. Price, paper *M*.32, bound *M*.40.

This is the thirteenth and final part of a treatise on the pathogenic protozoa and includes seventy-five pages dealing with the insect flagellates, leishmania and trypanosomes. Individual chapters are devoted to the species of the genus *Trypanosoma*, and discuss their vectors and the methods of their transmission. An index (pp. 2144–2171) to the three volumes of the complete text-book is appended.

DUKE (H. L.). ***Trypanosoma gambiense* in Monkeys and Ruminants ; Prolonged Infection, Immunity and Superinfection.**—*Parasitology*, xxiii, no. 3, pp. 325–345, 7 refs. Cambridge, July 1931.

A number of tests previously carried out on the behaviour of strains of *Trypanosoma gambiense* recently isolated from man in the blood of monkeys and of certain domestic ruminants are recapitulated [*R.A.E.*, B, xvii, 39, 60 ; xix, 65], and additional studies are described, in some cases completing the history of the animals up to their death. The experiments discussed show a remarkable agreement in indicating a decrease in the transmissibility of *T. gambiense* when it remains for long in one

and the same animal. The infectivity of the strain in the gut of *Glossina palpalis*, R-D., apart from its transmissibility, also tends to diminish as the sojourn in the mammal increases. The diminution in the adaptation of a strain to *G. palpalis* may progress to a complete loss of transmissibility, and once this stage is reached it is highly improbable that transmissibility can ever be recovered. On the other hand, there is reason to believe that in many cases diminution is the effect of inhibitory influences exerted on the trypanosome in the course of time by the tissues of the mammalian host, and that the strain once freed from these influences by introduction into another and non-immune host may recover in the latter, temporarily at all events, its original transmissibility. The transmissibility of a strain, though greatly reduced, may persist for a long time, often up to the death of the host. The additional evidence accumulated makes it quite clear that *T. gambiense* can persist in a transmissible form in sheep for more than a year, and there is no evidence that infection with strains of *T. gambiense* recently isolated from man necessarily shortens the life of sheep or goats. It is highly probable that in addition to individual differences between different strains of trypanosome in their ability to utilise *G. palpalis*, individual mammalian hosts differ in their attitude towards the trypanosome, some being more congenial to it than others. There is at present little actual experimental evidence that cyclical passage through the fly has the same stimulating effect on the transmission of the strain as direct inoculation into a new host. In three strains of polymorphic trypanosomes from natural sources other than man, transmissibility by *G. palpalis* has been lost during a period of maintenance by syringe passage of many months' duration. Other strains isolated from man have been found to be non-transmissible in subinoculated animals, and one strain was found to be completely non-transmissible and all but non-infective to tsetse. Studies of prolonged and superinfection indicate that prolonged infection with *T. gambiense* leads to the development in the mammal of immunity from this trypanosome. This immunity acts first upon the transmissibility of the strain by tsetse and has no demonstrable effect on the mere presence of trypanosomes in the animal's circulation. The transmissibility is reduced to a low level and is sometimes abolished altogether, and whereas this immunity develops gradually in the course of infection with a single strain, superinfection stimulates its production and intensifies its effect. An infected animal is not necessarily infective to *G. palpalis*, and the constant exposure of adult animals to tsetse-flies will tend sooner or later to their elimination from the circle of infection.

LE GAC (—). **L'épidémie de fièvre récurrente au Ouadaï (Tchad) 1925–1928.**—*Ann. Méd. Pharm. col.*, xxix, no. 1, pp. 148–165, 4 refs. Paris, 1931.

A detailed account is given of an outbreak of relapsing fever at Wadi, French Equatorial Africa [*cf. R.A.E.*, B, xiv, 35]. The disease was undoubtedly imported from French West Africa and Nigeria by pilgrims travelling to Mecca. *Ornithodorus moubata*, Murr., was not observed, and all available evidence points to the conclusion that lice [*Pediculus*] were the transmitting agents.

CLARK (H. C.), DUNN (L. H.) & BENAVIDES (J.). **Experimental Transmission to Man of a Relapsing Fever Spirochete in a wild Monkey of Panama**—*Leontocebus geoffroyi* (**Pucheran**).—*Amer. J. Trop. Med.*, xi, no. 4, pp. 243–257, 6 refs. Baltimore, Md., July 1931.

In May 1930 a young squirrel-monkey (*Leontocebus geoffroyi*) caught in Panama was found to be infected with spirochaetosis, and in August two monkeys of the same species from a different locality showed a scant or latent infection with apparently the same spirochaete. The infection was transmitted from the first monkey to small rodents and other species of monkeys, but none proved so susceptible as the squirrel-monkeys. The morphology of the spirochaete corresponds very closely to that of the various species causing relapsing fever in man. The infection was successfully transferred to man by inoculation and by the bites of 31 nymphs and adults of *Ornithodorus venezuelensis*, Brumpt, previously fed on an infected monkey. No infection resulted when 60 larval ticks hatching from eggs deposited by these adults were allowed to feed on man. The disease produced by the inoculation of a young squirrel-monkey with blood from a case of ordinary relapsing fever in man was apparently the same as the naturally acquired spirochaetosis. Blood-film surveys of the rural population in Panama indicate that the usual severe hospital case of relapsing fever in man probably does not represent the average case in rural communities, many of which have no severe relapses.

During the past year *O. venezuelensis* and *O. talaje*, Guér., have been found on fowls, and the latter species on opossums and rats. A spirochaetal infection indistinguishable from relapsing fever has also been observed in two opossums and two armadillos. There is evidence to suggest that relapsing fever in Panama is primarily a disease of animals rather than of man, and the spirochaete found in the squirrel-monkey is considered identical with the local species causing relapsing fever in man.

CARLEY (P. S.). **Results of the Dissection of 1,017 wild-caught Anophelines in Jamaica.**—*Amer. J. Trop. Med.*, xi, no. 4, pp. 293–296, 1 map, 1 ref. Baltimore, Md., July 1931.

Of 1,017 Anophelines caught in five different localities in Jamaica from October 1929 to December 1930, two individuals of *Anopheles albimanus*, Wied., showed infection with malarial parasites, one in the stomach and the other in the salivary glands, and one individual of *A. grabhami*, Theo., was found to contain a single oöcyst in the stomach. As many of these mosquitos were caught some time after intensive control measures had been instituted, it is probable that the results do not represent the usual indigenous infection rates. Excellent results were obtained by the method for removing salivary glands described by Barber [*R.A.E.*, B, xviii, 253].

DAVIS (N. C.). **Estudos sobre febre amarella. O effeito do calor e do frio sobre o desenvolvimento da infectividade nos** *Aëdes aegypti*. [Studies on Yellow Fever. The Effect of Heat and Cold on the Development of Infectivity in *A. argenteus*.]—*Brasil-Medico*, xlv, no. 4, pp. 77–78, 3 refs. Rio de Janeiro, 24th January 1931.

This is the author's summary of a detailed paper to be published elsewhere on a large series of experiments at Bahia on the effect of

temperature on the incubation period of yellow fever in *Aëdes argenteus*, Poir. (*aegypti*, auct.). The mosquitos were kept in a saturated atmosphere to avoid the influence of varying moisture and were subjected to the experimental temperatures immediately after feeding on the infected animals. Fatal infections in *Macacus rhesus* were produced by mosquitos kept under the following conditions: 2 days at 38° C. [100·4° F.] and then 2 days at 36° C. [96·8° F.]; 5 days at 36° C. [96·8° F.]; 6 days at 31° C. [87·8° F.]; or 8 days at room temperature, which averaged about 25° C. [77° F.]. Mosquitos kept for 30 days at 18° C. [64·4° F.] were not infective, but became so after a further 6 days at room temperature. This indicates some development of infection at the lower temperature, but does not agree with an experiment by Hindle [*R.A.E.*, B, xix, 109] in which the mosquitos were infective after 20 days at 15–18° C. [59–64·4° F.]. Mosquitos kept for 28 days at 8° C. [46·4° F.] were not infective, but infected a monkey fatally after being kept for a further 18 hours at room temperature and then for 6 days at 36° C. [96·8° F.]. Mosquitos kept at 36° C. caused fatal infections at the end of 5 and 7 days, but after 20 days they produced only one non-fatal infection. This attenuation of the virus, was, however, only temporary, for fatal infections resulted after 20 days, when the disease was transmitted from the infected animal to others by inoculation and mosquito bites. Mosquitos kept for 7 hours at 40° C. [104° F.] and then at room temperature were allowed to bite 17 and 28 days afterwards. Non-fatal infections resulted. Mosquitos that originally belonged to the same batch, but had not been subjected to the high temperature, produced a rapidly fatal infection after 28 days. Six mosquitos that survived exposure to 45° C. [113° F.] for 2 hours were kept at room temperature for 15 days, after which they caused a fatal infection. These experiments indicate that there may be some attenuation of the virus after prolonged exposure to high temperatures, but the mosquitos are very susceptible to high temperatures and will die before the virus is destroyed.

BLANC (G.) & CAMINOPETROS (J.). **Comment les faits épidémiologiques, en Grèce, montrent le rôle exclusif joué par le** *Stegomyia fasciata* (*Aëdes aegypti*) **dans la transmission de la dengue.**—*Arch. Inst. Pasteur hellénique*, ii, no. 2, pp. 277–294, 7 figs., 14 refs. Athens, 1930.

An epidemiological survey in Greece, including Macedonia, is described, the results showing that the distribution of dengue in these countries coincides exactly with that of *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) and that the disease is transmitted by this mosquito only. The areas (particularly western Macedonia) that are free from *A. argenteus* are those that escaped the epidemic. The absence of this mosquito is due to the fact that every village and dwelling has its own stream of running water, no water is stored and so no breeding-places are provided. In other areas, where there is no running water and water is stored in and about houses, the mosquito is abundant. *Phlebotomus papatasii*, Scop., is common throughout Greece and in all the villages and towns in the western part of Macedonia surveyed. In the city of Salonika dengue occurred in certain areas where *A. argenteus* was prevalent, and there were few if any cases where it was not found but where *Culex* and sandflies were numerous.

Bragina (A.). **Prilog proučavanju biologije** *Phlebotomus*-**a. Novi parazit** *Phlebotomus*'**a.** [Contribution to the Study of the Biology of *Phlebotomus*. A new Parasite of *Phlebotomus*.] [*In Serbian.*]—*Glasnik Tzentr. Khig. Zavoda*, vi (xi), no. 1–3, pp. 80–83, 3 figs., 1 ref. Belgrade, 1931. (With a Summary in French.)

Adult mites were found in Skoplje (southern Serbia) on a female sandfly, probably *Phlebotomus perniciosus*, Newst., and on a male of *P. papatasii*, Scop. They apparently belong to the group that live on the surface of the soil, in dark and slightly damp corners, and it is probable that the sandflies breed in such places, as mites usually attack adult insects at the moment of their emergence from the pupa.

Donatien (A.) & Lestoquard (F.). **Les theilérioses.**—*Rev. vét.*, lxxxiii, pp. 305–331, 2 pls., 7 figs. Toulouse, June 1931.

Present knowledge on the subject of diseases caused by *Theileria* is reviewed, and the authors conclude that there are only three valid species, *Theileria parva*, *T. dispar* and *T. mutans*, that are pathogenic to cattle, and two, *T. ovis* and *T. recondita*, that are pathogenic to sheep. The ticks that transmit these are briefly discussed.

Roubaud (E.). **Invasion domicilaire spontanée produite par la puce des rongeurs indigènes,** *Ceratophyllus fasciatus* **Bosc.**—*Bull. Soc. Path. exot.*, xxiv, no. 5, pp. 383–384, 1 ref. Paris, 1931.

The infestation of a house by *Ceratophyllus fasciatus*, Bosc, in the summer of 1930, is recorded from France. It appeared suddenly and only lasted a few weeks, during which the occupants, particularly the children, were attacked. It is thought possible that rats or mice harbouring this flea had hibernated under the house or the roof, and that the outbreak was due to adults maturing from larvae after the rodents had left their winter quarters.

Roubaud (E.). **Sur l'autogénèse chez** *Culex pipiens*.—*Bull. Soc. Path. exot.*, xxiv, no. 5, pp. 384–387. Paris, 1931.

Further observations on the autogenous strain of *Culex pipiens*, L. [*R.A.E.*, B, xviii, 169] indicated that autogenesis (reproduction without the females having fed) is only possible where larval development takes place in a medium sufficiently rich in nutritive material. A medium having produced autogenous mosquitos may, when the nutritive elements are exhausted, produce only non-autogenous ones, and cases have been observed where autogenesis is intermittent in the same breeding ground according to fluctuations in the quantities of nutritive matter present. It was found that in no case can females of the autogenous race that have lost the autogenous faculty or fail to manifest it be induced to oviposit by feeding on a purely vegetable diet such as liquid containing sugar [*cf.* xviii, 94]. Females capable of oviposition after receiving such food are autogenous females that would have been capable of developing eggs even if they had received no food at all. Although they may survive for weeks after the first oviposition if fed on water rich in organic matter, autogenous females can only oviposit again after a blood meal. Individuals resulting from such oviposition regain the autogenous property, if the conditions of larval feeding admit of it, to the same extent as the direct descendants of autogenous oviposition.

Swezey (O. H.). **Entomology.**—*Rep. Comm. Expt. Sta. Hawaiian Sugar Pl. Ass. 1929–30*, pp. 23–30. Honolulu, 1931.

The carnivorous mosquito, *Megarhinus inornatus*, Wlk., recently introduced into Hawaii [*R.A.E.*, B, xviii, 251] has proved disappointing. It breeds continuously in tubs in which larvae of day-flying mosquitos are present, but not in the small rock pools or the rot holes in trees where such mosquitos usually breed. Neither does the presence of *Copris incertus* var. *prociduus*, Say (Mexican dung beetle) seem to have made any appreciable difference to the breeding of the hornfly [*Lyperosia irritans*, L.] in cowdung, against which it was introduced.

Zanini (E.). **È l'*Holostaspis badius* (Koch) parassita della mosca domestica ? Contributo alla lotta contro la mosca domestica.** [Is *H. badius* a Parasite of the House-fly ? A Contribution to the Control of the House-fly.]—*Boll. Lab. Zool. agrar. Bachic. Milano*, i (1928–29), pp. 59–73, 2 figs., 2 pls., 4 refs. Milan, 1930. [Recd. July 1931.]

House-flies [*Musca domestica*, L.] in Venetia and Lombardy are heavily infested in autumn by the Gamasid, *Holostaspis badius*, Koch, and the possibility of breeding this mite, which is described in detail, is suggested as a measure against them.

Papers noticed by Title only.

Covell (G.). **The Distribution of Anopheline Mosquitoes in India and Ceylon : Additional Records, 1926-1930.**—*Rec. Malaria Surv. India*, ii, no. 2, pp. 225–268, 6 pp. refs. Calcutta, June 1931. [*Cf. R.A.E.*, B, xv, 96.]

Tegoni (B.) & Williams (B. A.). **Indice bibliografico della malaria.** [Index to the Literature on Malaria.] **IV. 1929.**—*Riv. Malariologia*, x, Suppl., 108 pp. Rome, 1931. [*Cf. R.A.E.*, B, xviii, 184.]

Brug (S. L.). **Filariasis in the Dutch East Indies.**—*Proc. Roy. Soc. Med.* xxiv, Sect. Trop. Dis., pp. 23–33, 5 figs., 1 diag., refs. London, April 1931. [*Cf. R.A.E.*, B, xix, 146 ; xviii, 206, etc.]

Blanc (G.) & Caminopetros (J.). **Recherches expérimentales sur la dengue.**—*Arch. Inst. Pasteur hellénique*, ii, no. 2, pp. 199–276, 12 figs., 66 refs. Athens, 1930. [See *R.A.E.*, B, xviii, 169.]

Blagoveshchenskiĭ (D. I.) & Pavlovskiĭ (V. N.). **Zur Biologie und zur Bekämpfung der Hautbremse** (*Hypoderma bovis* **De Geer**). [On the Biology and Control of *H. bovis* in the Novgorod Government.]—*Z. Parasitenk.*, iii, no. 2, pp. 185–204, 2 figs., 9 refs. Berlin, 20th April 1931. [*Cf. R.A.E.*, B, xix, 115.]

Hobson (R. P.). **Studies on the Nutrition of Blow-fly Larvae. i. Structure and Function of the Alimentary Tract.**—*J. Exper. Biol.*, viii, no. 2, pp. 109–123, 4 figs., 27 refs. London, April 1931.

Bishopp (F. C.) & Dove (W. E.). **The Horse Bots** [*Gastrophilus* spp.] **and their Control.**—*Fmrs'. Bull. U.S. Dept. Agric.*, no. 1503 revd., 14 pp., 8 figs. Washington, D.C., March 1931. [*Cf. R.A.E.*, B, xv, 50.]

Jordan (K.). **Three new South American Fleas.**—*Novit. Zool.*, xxxvi, no. 3, pp. 311–316, 5 figs. Tring, 3rd September 1931.

Buxton (P. A.). **The Thermal Death-point of** *Rhodnius* [*prolixus*, Stål] (**Rhynchota, Heteroptera**) **under controlled Conditions of Humidity.**—*J. Exper. Biol.*, viii, no. 3, pp. 275–278, 1 fig., 4 refs. Edinburgh, July 1931.

Adler (S.) & Theodor (O.). **Investigations on Mediterranean Kala Azar. I.—Introduction and Epidemiology. II.—***Leishmania infantum.* **III.—The Sandflies of the Mediterranean Basin. Distribution and Bionomics of Sandflies in Catania and District. IV.—Infection of Sandflies with** *Leishmania infantum.* **Natural Parasites of wild Sandflies in Catania. Observations on** *Trypanosoma ptyodactyli* **Catouillard. V.—Distribution of Sandflies of the** *major* **Group in Relation to Mediterranean Kala Azar.**—*Proc. Roy. Soc.*, (B) cviii, no. B 759, pp. 447–502, 1 pl., 9 figs., 2 pp. refs. London, August 1931.

Visceral leishmaniasis (infantile kala-azar) is distributed irregularly throughout the whole Mediterranean basin and is constantly present in certain localities, the three largest foci being Catania (150–200 cases annually), Naples (70 cases) and Palermo (70 cases), with their neighbouring villages. In the larger foci visceral leishmaniasis always occurs in both man and dogs, but its relative incidence in the two hosts varies in different foci. It is suggested that the discrepancy in the distribution of human and canine visceral leishmaniasis in Italian and Greek foci may be sought in differences in the bionomics of the insect vectors in these areas.

The epidemiology of Mediterranean kala-azar, which is discussed, and the fact that *Leishmania infantum* was found in the peripheral blood of 91·7 per cent. of the cases indicate that it is probably transmitted by biting insects. Such insects must have a sterile alimentary tract (as *Leishmania* cannot survive in the presence of bacteria) and a distribution that bears some relation to that of the disease. In Catania these conditions are fulfilled by sandflies [*cf. R.A.E.*, B, xix, 120]. The distribution of *Phlebotomus perniciosus*, Newst., in Italy coincides very closely with that of kala-azar. Both are absent at high altitudes in Sicily, rare in the interior and most common on the coastal plain. *P. papatasii*, Scop., is more widely distributed than kala-azar and is found at altitudes of 3,600 ft. where the disease does not occur. The distribution of a local race of *P. major*, Ann., in Catania is more restricted than that of the disease, but it is common in two intense foci.

When *P. perniciosus*, *P. major*, *P. papatasii* and *P. sergenti*, Parr., were fed on a Chinese hamster (*Cricetulus griseus*) infected with *Leishmania infantum*, the respective infection rates were 96·8, 92·3, 3·5 and 0 per cent. It is therefore obvious that *L. infantum* is better adapted to *P. perniciosus* and *P. major* (both belonging to the *major* group) than to *P. papatasii* and *P. sergenti*. When *P. papatasii* was fed on bone marrow showing one parasite in 40 fields (a much larger number than that found in the peripheral blood of human cases), the infection rate was nil and, even when there were 7 parasites per field, the rate was never higher than 26 per cent. [xviii, 235]. *P. papatasii* can, therefore, be practically excluded as a vector of kala-azar in Sicily.

Of 63 individuals of *P. perniciosus* fed on 5 cases of kala-azar in man, 4 were subsequently infected, but no infection resulted when 130 individuals of *P. papatasii* were fed on 6 cases. Of 751 individuals of *P. perniciosus* and 3,839 of *P. papatasii* caught in or near infected houses, only one of the former was infected.

From a study of the types of flagellates and their situations, it is evident that in *P. perniciosus*, *L. infantum* undergoes a definite cycle in which fairly definite morphological forms follow in regular order.

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Flagellates are found among the terminal teeth of the epipharynx as early as the sixth day, and when they reach this position, their entry into the skin during the act of biting appears inevitable. Experiments on the exit of *L. infantum* from the proboscis of *P. perniciosus* have already been noticed [xix, 10]. For these reasons the authors conclude that *P. perniciosus* is the important vector of kala-azar in Sicily.

A study of the bionomics of *P. perniciosus* showed that it is present throughout the sandfly season (about the end of May to the end of October), but it is most prevalent from the middle of August to the middle of October, and particularly in the second half of this period. The progeny of the third or fourth generation hibernates as fourth stage larvae even if the eggs and larvae are kept at 30° C. [86° F.], the optimum temperature for the development of the other generations. Moreover, this temperature is harmful to the hibernating larvae and produces a mortality of 70–90 per cent. Hibernation is not simply an adaptation to low temperatures, but an essential part of the life-cycle of Sicilian *P. perniciosus*. This species feeds more readily on mules and cattle than on man, and more readily on man than on laboratory animals.

The distribution of the sandflies of the Mediterranean basin is given, with keys to the males and females, and in some cases brief notes on classification. The new forms described are *P. macedonicus*, sp. n., from Macedonia, *P. canaaniticus*, sp. n., from Palestine, and *P. major* var. *syriacus*, n., which is the form of *P. major* occurring in Syria and Palestine [*cf.* xvii, 187]. With regard to other species, it is pointed out that *P. perniciosus* has been recorded from Greece and Macedonia, but that this was probably due to the confusion of this species with *P. macedonicus* and a race of *P. chinensis*, Newst. ; *P. larroussei*, Langeron & Nitzu., is regarded as a synonym of *P. vesuvianus*, Adl. & Theo. [although the former is the earlier name (xix, 114, 121)] ; and the four geographical races of *P. chinensis* occurring in the Mediterranean basin are described.

In Catania the gecko, *Tarentola mauretanica*, was found to be free from infection with *Leishmania*, and as inoculation with *L. infantum* gave negative results, it is concluded that it is not a reservoir of the disease. *Phlebotomus minutus*, Rond., and *Leishmania tarentolae* are both absent from Catania and both present in Tunis and Algeria, and the possibility of *P. minutus* being the carrier of *L. tarentolae* should therefore be considered. Brief notes on the relation of sandflies to the trypanosome (*Trypanosoma ptyodactyli*) found in this gecko are given.

The distribution of sandflies of the group of *P. major* in relation to Mediterranean kala-azar is reviewed, and a brief analysis is given of the behaviour of various species of *Leishmania* in different sandflies, with references to the literature on this subject.

Fuller (M. E.). **The Life-history of** *Calliphora ochracea* **Schiner (Diptera, Calliphoridae).**—*Proc. Linn. Soc. N.S.W.*, lvi, pt. 3, pp. 172–181, 2 figs., 13 refs. Sydney, 15th July 1931.

Calliphora ochracea, Schin., which has been recorded from New South Wales and Queensland, has been confused with *C. nigrithorax*, Mall. (*Ochromyia hyalipennis*, Macq. 1850 *nec* 1835), which occurs in Tasmania and is considered a distinct species.

In its early stages, which are described, *C. ochracea* is remarkably like other species of the genus ; the maggot is very similar in detail to that of *C. stygia*, F., and the only real distinction lies in the spiracles. An account is given of successful rearing experiments in the laboratory, including notes on technique, duration of stages, and effect of temperature and humidity on rate of development. The breeding habits in the field are not known. Experimentally the maggots thrive in carrion, but have never been found in carcases in the field, so it seems not unlikely, as the flies readily oviposit in thick fur, that they are restricted to the dead bodies of some particular native animal.

VANDENBERG (S. R.). **Report of the Entomologist.**—*Rep. Guam Agric. Expt. Sta. 1929*, pp. 16–17. Washington, D.C., February 1931.

In continuation of previous work [*R.A.E.*, B, xix, 89], methods for rearing *Spalangia* sp., a parasite of the house-fly [*Musca* sp.] and the stable-fly [*Stomoxys calcitrans*, L.], were improved. Losses from a fungus attacking the fly pupae were practically eliminated by keeping them in partly decomposed pine shavings instead of earth, etc. This medium also permitted the maintenance of optimum moisture conditions, and its texture allowed the parasites to move about easily in search of pupae. Liberations of *Spalangia* were made in practically all districts, but its natural spread is evidently slow, though it appears to be increasing under natural conditions.

BARRY (W. C.). **Sarcoptic Mange of Pigs. Treatment and Control Measures.**—*N.Z. J. Agric.*, xlii, no. 6, pp. 395–398, 1 fig. Wellington, June 1931.

Pigs infested with *Sarcoptes* [*suis*, Gerl.] have recently been discovered on several farms in one district of New Zealand, and as there is evidence that this form of mange is extensively distributed, a brief account of it and its control is given. Hand-dressing with crude petroleum (fuel oil), flowers of sulphur and raw linseed oil in the proportion of 1 to 4, or kerosene and lard in the proportion of ¼ pt. to 1 lb. is only recommended for treating a small number of pigs on account of the time and labour necessary for thorough application. Dressings should be repeated after an interval of about a week. Dipping is the most effective and economical method of treatment. The most satisfactory materials are crude petroleum poured on the top of water in the dip to a depth of 6–8 ins., or lime-sulphur. The latter dip is prepared by mixing 25 lb. flowers of sulphur with 12½ lb. quicklime and grinding the mixture with water until a smooth cream results ; the volume of the cream should be brought up to 20 gals. with water, and the liquid boiled and stirred for ½ hr. or longer until it assumes a dark red colour (keeping the volume at 20 gals.) ; after cooling, it should be decanted and diluted to 100 gals. All litter should be burned or buried. The pens should be thoroughly sprayed and the floors washed with strong disinfectant, and all woodwork, including rubbing places, such as gate-posts, etc., should be tarred or lime-washed. After dipping, the pigs should be removed to a fresh site and the original pens left unoccupied for six weeks. Details for the construction of a concrete dipping tank are given.

Ridlon (J. R.). **Experiments with certain Fumigants used for the Destruction of Cockroaches.**—*Publ. Hlth. Rep.*, xlvi, no. 28, pp. 1623–1636, 9 refs. Washington, D.C., 10th July 1931.

Cockroaches are extremely common in many ships, the species observed at the port of San Francisco being *Blattella germanica*, L., which is the most common, *Blatta orientalis*, L., which is not uncommon in vessels from Mexican and Central American ports, and *Periplaneta americana*, L., which is only occasionally seen in vessels from warm climates. During the period August 1929 to February 1930, tests were carried out with various fumigants in an attempt to discover a satisfactory means of destroying these pests. The results are shown in tables, giving details of the fumigant, the amount used and the time of exposure. Zyklon B, and liquid hydrocyanic acid gas with 5 per cent. chloropicrin, both in the proportion of 60 gm. per 1,000 cu. ft., were the only two fumigants that were effective in destroying cockroaches in two hours, which is the usual time of exposure for an empty vessel. Liquid hydrocyanic acid with 20 per cent. cyanogen chloride in the proportion of 90 gm. per 1,000 cu. ft. was effective in 7 hours.

Williams (C. L.). **Effect of Fumigation on Cockroaches on Ships.**—*Publ. Hlth. Rep.*, xlvi, no. 29, pp. 1680–1694, 2 refs. Washington, D.C., 17th July 1931.

In view of the fact that cockroaches in ships are frequently not eradicated by fumigations that are effective against rats, experiments were undertaken to determine the dosage of hydrocyanic acid gas and exposure necessary to exterminate *Blattella germanica*, L., the cockroach most usually observed in ships in New York. In the laboratory it was found that the dosage of 2 oz. (60 gm.) HCN per 1,000 cu. ft. with an exposure of 2 hours that is used for the destruction of rats only kills cockroaches, including eggs, if maintained at full concentration throughout the exposure and in the absence of shelter. A dosage of 4 oz. is required in the presence of shelter. In tests in various ship's compartments it was found that the actual average concentration cannot be counted on as exceeding half that calculated, and to give a reasonable margin a dosage of at least 10 oz. per 1,000 cu. ft. should be used. The cost of fumigating an entire ship at this rate appears unjustifiable, and on ships where the holds are heavily infested, eradication in the superstructure alone would be futile. On the other hand, cockroach infestation is often largely confined to the galley, pantry, store-room and forecastle, and, as the cubic capacity of the superstructure is relatively small, the cost of the additional amount of fumigant required in such cases is probably justifiable. Dissipation of the fumigant is often rapid unless all small openings in the superstructure are sealed. It was experimentally demonstrated that the use of 5 or 10 per cent. chloropicrin as a lachrymatory warning gas does not interfere with the lethal action of HCN to an extent that can be noticed. Details of the experiments are shown in tables.

Ewing (H. E.). **Some Factors affecting the Distribution of and Variation in North American Ectoparasites.**—*Amer. Nat.*, lxv, no. 699, pp. 360–369, 1 map, 5 refs. New York, N.Y., 1931.

The following is taken from the author's summary: Ectoparasites that spend a part of their life detached from their hosts are affected

by most of the factors that determine the distribution of the latter and by many others that affect them during their free-living periods. The much greater diversity of species and genera in the western part of North America appears to depend fundamentally on natural barriers in the form of high mountain ranges and on the diversity of climate, which is largely determined by these ranges. The distribution in the northern part of the United States of three closely related ticks of the genus *Dermacentor* is briefly reviewed from this point of view. A list is given of records of the occurrence of *Pulex irritans*, L., in the United States, and its peculiar distribution is discussed. Its presence or abundance appears to depend partly upon the following factors: the proper moisture content in the soil and the absence of surface water during the larval period; the absence of extremely low temperatures; the presence of human habitations or of hosts other than man, the hosts for a particular region not yet being known; and the habits of all hosts (including man) in the region under consideration. A study of the records of the occurrence and abundance of fleas in general and of *P. irritans* in particular appears to indicate that the abundance of individuals is largely independent of the total annual precipitation or humidity during the adult stage.

Dyer (R. E.), Ceder (E. T.), Rumreich (A.) & Badger (L. F.). **Typhus Fever. The Rat Flea,** *Xenopsylla cheopis*, **in experimental Transmission.**—*Publ. Hlth. Rep.*, xlvi, no. 32, pp. 1869–1870, 5 refs. Washington, D.C., 7th August 1931.

An account is given of experiments on the transmission of endemic typhus [Brill's disease] by the rat flea, *Xenopsylla cheopis*, Roths. Fifty fleas from rats trapped in Baltimore were placed in a cage with white rats injected with strains of endemic typhus. About two weeks later, 6 fleas were removed, emulsified in normal saline, and injected into two guineapigs, one of which subsequently developed endemic typhus. Healthy rats and additional infected ones were then placed in the cage, and about two weeks later one of the originally uninfected rats was removed and killed. Six fleas from this rat were emulsified and injected into two healthy guineapigs, both of which developed endemic typhus. The brain and spleen from this rat were also inoculated into guineapigs, which developed endemic typhus. The fleas remaining in the first cage were then transferred to a second cage, in which infected and uninfected white rats were placed. After about two weeks one of the originally uninfected rats was removed and on being treated in a similar way to the previous one, gave similar results. A third rat from the same cage again gave the same results.

Roubaud (E.). **Prédominance de** *Synosternus pallidus* **Taschenb.** (*Xenopsylla pallida*) **comme puce domestique dans certaines régions pesteuses du Sénégal.**—*Bull. Soc. Path. exot.*, xxiv, no. 7, pp. 551–554, 3 figs., 3 refs. Paris, 1931.

Examination of collections of fleas from Senegal has shown that, during one season of the year at least, *Synosternus pallidus*, Tasch., is the predominant domestic species, being 20 times as numerous as *Xenopsylla cheopis*, Roths. The characters distinguishing these

two species are discussed. In view of the prevalence of *S. pallidus* in certain provinces of Senegal where plague is endemic, the necessity for determining the part it plays in the dissemination of the disease is pointed out. Its abundance as a domestic flea would suggest that it is a vector of importance, but, if it were as effective a carrier as *X. cheopis*, its rapid multiplication in the villages of Cayor would have produced much more severe epidemics than those actually recorded. The relatively limited extent of the local epidemic agrees with the comparative scarcity of *X. cheopis*, which, as a domestic species, is apparently much rarer than has previously been supposed [*cf. R.A.E.*, B, xviii, 249].

BACIGALUPO (J.). **Evolution de l'*Hymenolepis fraterna* Stiles, chez *Pulex irritans* L., *Xenopsylla cheopis* Rothschild et *Ctenocephalus canis* Curtis.**—*Ann. Paras. hum. comp.*, ix, no. 4, pp. 339–343, 2 figs., 8 refs. Paris, July 1931.

A total of 50 larvae of *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., 6 of *Pulex irritans*, L., and 10 of *Xenopsylla cheopis*, Roths., were fed on the eggs of *Hymenolepis fraterna*. After 10 days, one larva of *C. canis* was found to contain a larva of *H. fraterna*. Five adults of *C. canis* emerged 17 days after the infecting feed, and cysticercoids of *H. fraterna* were observed in two of them. In one of the three individuals of *P. irritans* and two of the four of *X. cheopis* that reached maturity, cysticercoids were also found.

The author concludes that the worm may complete its development during the larval stage of the host if this lasts sufficiently long, otherwise it does so in the adult stage.

MACDOUGALL (R. S.). **Insects and other Invertebrates in 1930.**—*Trans. Highl. Agric. Soc. Scotland*, 1931, reprint, 46 pp., 22 figs., num. refs. Edinburgh, 1931.

The control of ox-warble flies [*Hypoderma*] in cattle is discussed. Reference is made to Cameron's observations on the oviposition of the Tabanid, *Haematopota pluvialis*, L. [*R.A.E.*, B, xviii, 272]. The characters of the adults, eggs and larvae of the horse bot-flies, *Gastrophilus* (*Gasterophilus*) *intestinalis*, DeG., *G. haemorrhoidalis*. L., and *G. nasalis*, L., are tabulated, and the bionomics and control of *G. intestinalis* are reviewed from the literature.

GLOVER (L. C.). **Suggestions on maintaining Cultures of Mosquito Larvae through the Winter.**—*J. Econ. Ent.*, xxiv, no. 4, pp. 896–898. Geneva, N.Y., August 1931.

A breeding pool devised to maintain a culture of *Culex pipiens*, L., so that larvae should be available throughout the winter is described. The equipment consisted of two adjacent concrete bins, each 29½ by 30 ins. and 20½ ins. deep, enclosed under a cage 34 ins. wide, 37 ins. high and 5 ft. 7 ins. long, covered with 16-mesh copper screening. One bin was waterproofed, fitted with a drain and overflow pipe, and had the bottom covered with about 3 ins. of mud from an outdoor mosquito breeding pool, and staves from a barrel weighted to the bottom with

pieces of granite. It was then filled with water, which was allowed to stagnate. The other was filled with loam and turfed over, two white pines and a cedar, each about 3 ft. high, being set in it. A door was built in the side of the cage in front of the pool.

Larvae of *C. pipiens* were added to the pool in early October 1929. As the development of the larvae and pupae was checked when the water became too stagnant, water was drained from the pool and the mud removed and replaced by fresh material twice during the winter. Some plant growth in the pool may retard extreme stagnation. Fresh apples or grapes were placed in the cage at regular intervals, and adults of both sexes fed on the fruit throughout the winter. As no breeding took place in October and November, white rats were placed in the cage, but the females refused to bite them. Eggs were deposited, however, 4–6 days after a meal on human blood and hatched in 2–4 days. No egg deposition was noted unless females had previously fed on blood. Larvae reared in other containers on dried blood, developed more rapidly than those in the pool, partly owing to the higher temperature and partly to the food supply. Larvae for use in any one experiment with insecticides, etc., should be reared under similar conditions to obviate variations in their resistance.

At a humidity of about 50 per cent. and a temperature of 80–95° F. adults are usually active and bite freely, staying away from the water. With lower humidities, or very high temperatures, they move about very little and alight on or near the surface of the water. In the insectary, temperature ranged from 60 to 100° F., with an average of about 80, and humidity ranged from 10 to 90 per cent., being often below 50.

WHITEHEAD (W. E.). **The Northern Fowl Mite.**—*J. Econ. Ent.*, xxiv, no. 4, p. 917. Geneva, N.Y., August 1931.

Although observations now indicate that *Liponyssus sylviarum*, C. & F., has occurred in the Province of Quebec for some time, it has only lately been reported there [*cf. R.A.E.*, B, xix, 185]. A list is given of six species of wild birds from which it has recently been taken. Extensive scabby areas on some fowls examined were attributed to the feeding of the mites followed by a secondary infection accentuated by the weakened condition of the birds.

GILDOW (E. M.) & HICKMAN (C. W.). **A new Treatment for** *Oestrus ovis* **Larvae in the Head of Sheep.**—*J. Amer. Vet. Med. Ass.*, lxxix (N.S. xxxii), no. 2, pp. 210–216, 3 figs., 4 refs. Detroit, Mich., August 1931.

The discovery in Idaho of minute, apparently newly deposited larvae of *Oestrus ovis*, L., in the nasal passages of sheep as early as 4th May and as late as 13th December precluded the recommendation of the regular use of repellents as a method of control, and attempts were made to discover some means of destroying the developing larvae found in the nasal sinuses during the winter months. Carbon bisulphide was found to be extremely toxic to the larvae, and can be introduced into the frontal sinuses (which are most often infested) through the middle nasal meatus. Excellent results were obtained

when the heads of 14 slaughtered sheep were treated on one side with 3 cc. of a solution of equal quantities of carbon bisulphide and thin mineral oil, the other side being left as a control ; 20 out of 23 larvae were killed on the treated sides, whereas 22 live larvae were found on the untreated ones. Less satisfactory results were obtained with 21 living sheep. After slaughter, examination of the heads revealed 6 out of 16 larvae dead on the treated sides and 9 living and 1 dead on the control sides. The success of the treatment depends entirely on the solution penetrating into the nasal sinuses. The presence of the drug in the nasal passage does not seem to kill minute larvae found there, probably because of the dilution of the carbon bisulphide vapours and its elimination during breathing. The lethal dose of carbon bisulphide for sheep, when given in equally divided portions in each nostril, is 6 cc.

SEDDON (H. R.), BELSCHNER (H. G.) & MULHEARN (C. R.). **Studies on cutaneous Myiasis of Sheep (Sheep Blowfly Attack).**—*Sci. Bull. Dept. Agric. N.S.W.*, no. 37, 42 pp. Sydney, July 1931.

In the first two parts of this paper, an account is given of observations and experiments carried out in New South Wales, which indicate that sheep vary in susceptibility to attack by blow-flies, and that the cause of this susceptibility is chiefly due to the conformation of the sheep. Breeding experiments indicate that conformation, and consequently the main factor of susceptibility, is inherited, and it is therefore suggested that by careful selective breeding, this tendency to attack might be largely eliminated. Observations show that the quality of the wool is not affected by breeding to reduce the factor of susceptibility.

The third part of the paper deals with dressings for infested sheep and has already been noticed from another source [*R.A.E.*, B, xix, 153].

BLANC (G.) & CAMINOPÉTROS (J.). **Recherches expérimentales sur la sensibilité au virus de la fièvre exanthématique des animaux domestiques porteurs de** *Rhipicephalus sanguineus*.—*C. R. Acad. Sci. Fr.*, cxciii, no. 4, pp. 258–259, 1 ref. Paris, 1931.

Experiments with dogs and other animals that are in habitual contact with man and are normal hosts of *Rhipicephalus sanguineus*, Latr., indicate that they are immune from the virus of Marseilles fever. Since this virus is hereditarily transmissible in the tick [*R.A.E.*, B, xix, 200], it appears that, in the Mediterranean region at least, it is preserved by transmission from tick to tick without the intervention of a domestic animal as a reservoir.

BLANC (G.) & CAMINOPÉTROS (J.). **De la sensibilité du spermophile** (*Citillus citillus*) **au virus de la fièvre boutonneuse.**—*C.R. Acad. Sci. Fr.*, cxciii, no. 8, pp. 374–375, 1 ref. Paris, 1931.

Numerous experiments indicate that *Citellus citellus* is very susceptible to the virus of Marseilles fever, whether obtained from man or from the tick, *Rhipicephalus sanguineus*, Latr. There is no clinical sign of the infection, but the blood, the viscera and the brain are

virulent. This ground squirrel is more receptive to the virus than man, and infection transmitted to man by its blood or viscera is stronger and more regularly typical than that obtained by inoculation of human blood or crushed ticks. The white mouse is susceptible, though less so than *Citellus*. There are various points of resemblance between Marseilles fever and Rocky Mountain spotted fever, and it remains to be established whether the differences may not be due to the difference in the intermediate host, etc.

Covell (G.). **Malaria Control by anti-mosquito Measures.**—Demy 8vo, xii+148 pp., 2 pls., 13 figs., 570 refs. Calcutta, etc., Thacker Spink & Co., Ltd. [1931]. Price 7*s*. 6*d*.

The literature dealing with measures against mosquitos has become so extensive that it is difficult for the average malaria worker to keep in touch with the different methods advocated, and this book has been compiled with a view to giving some account of them in a convenient form. The three parts deal with protection against bites of mosquitos and measures directed against the adults and against the larvae. A bibliography of 570 references, classified according to subject, an appendix showing the prices of anti-mosquito apparatus and the places from which it may be obtained, and an index are also included. The discussion of the subject of drainage has been restricted to a brief description of the points of practical importance to the malariologist.

Mesnard (J.) & Morin (H.). **Réceptivité naturelle de** *Anopheles* (*Myzomyia*) *aconitus* **à l'infection par l'hématozoaire du paludisme en Cochinchine.**—*Bull. Soc. Path. exot.*, xxiv, no. 7, pp. 554–556. Paris, 1931.

In January 1930, one out of six individuals of *Anopheles aconitus*, Dön., taken in Cochin China was found to be infected with zygotes of *Plasmodium falciparum* (*praecox*). In December, 5 individuals out of 68 harboured malarial parasites. *A. aconitus* has been taken in many malarious districts, but in the south of Indo-China it appears to be much less prevalent than *A. minimus*, Theo. [*cf. R.A.E.*, B, xviii, 208 ; xix, 50]. It seems to be found more easily in the dry season (which is also the coldest) and at higher altitudes and latitudes. The larvae often occur in association with those of *A. minimus*. Under natural conditions, the rate of infection in each species appears to be about 7 per cent. Negative results were obtained on dissection of a total of 500 individuals of the following Anophelines : *A. barbirostris*, Wulp, *A. hyrcanus* var. *sinensis*, Wied., *A. fuliginosus*, Giles, *A. maculatus*, Theo., *A. karwari*, James, *A. philippinensis*, Ludl., *A. jamesi*, Theo., *A. vagus*, Dön., *A. kochi*, Dön., *A. leucosphyrus*, Dön., and *A. tessellatus*, Theo.

Bose (K.). **Application and Use of Larvicides.**—*Ind. Med. Gaz.*, lxvi, no. 8, pp. 436–440, 2 figs., 3 refs. Calcutta, August 1931.

The author discusses the various mosquito larvicides used in the anti-malaria campaign at Birnagar [*cf. R.A.E.*, B, xix, 204]. The mixture of crude oil and solar oil first used was wholly superseded by a proprietary mixture of crude oil and kerosene, which gives a better film. Where breeding pools, such as tanks, are free from vegetation, oil

should be sprayed at the edges, but in weed-covered breeding-places extensive clearing has to be carried out regularly before oil is applied if the larvae are to be effectively controlled. Experiments were also undertaken with soluble cresol (50 per cent. creosote, corresponding to 10 per cent. cresylic acids, the rest being soap and water), which penetrates slowly through thick vegetation and kills both Culicine and Anopheline larvae. This does not apparently kill mosquito eggs, as numerous first stage larvae were found on the day after application ; these larvae, however, perished during the course of the day. Aquatic vegetation turned brown and was partly controlled, and if the oil had been applied at a greater strength or more frequently, the control of the vegetation might have been more satisfactory. This larvicide, however, cannot be employed on tanks used by the public. The most satisfactory method of larval control has been the application of a mixture of Paris green and brick dust (5 : 95) applied by means of rotary blowers. This dust penetrates the grasses and weeds and spreads evenly over the water surface. Where the water surface was covered with lotus leaves, the dust blew under as well as over them. Thus no weed clearing is necessary. Paris green is applied every 6 days except during the winter season (December to mid-February), when the retardation in the development of the larvae enables the interval to be extended to 8 days. The proprietary mixture of crude oil and kerosene is now applied to tanks used for domestic purposes, except in the case of three tanks covered with aquatic vegetation that cannot be adequately dealt with by oil, owing to the enormous cost of periodical weed clearance. These tanks and all marshes, pools and disused tanks are dusted with Paris green. Since the introduction of tube wells in Birnagar in 1925, tank water is rarely used for drinking, but it is still employed for cooking and washing, and a watch will therefore be kept for any symptoms of insidious poisoning amongst people using water from the tanks treated with Paris green. Treatment with soluble cresol has been discontinued, as Paris green, which is distinctly cheaper, is now applied on all waters not used for domestic purposes.

MANSON (D.). **Some Observations on a Malaria Survey carried out in the Jorhat District of Assam.**—*J. Trop. Med. Hyg.*, xxxiv, no. 11, pp. 149–155, 5 refs. London, 1st June 1931.

A malaria survey of tea gardens in this district was begun on 5th July 1930, and the results obtained up to 31st December 1930 are here dealt with. Preliminary work on the relation of malaria to loss of labour, spleen indices, parasite rate and type of infection are discussed, and the geography, geology and climate of the district are described in detail. The incidence of malaria is highest in July–September, declines rapidly in October–November and is lowest in January–March. The maximum rainfall occurs from June–September, with a rapid decline in October, and the minimum in November–February. There is a direct correlation between temperature and rainfall, which shows a maximum rise corresponding to but preceding the rise in the incidence of malaria. Moreover, the amount of malaria seems to be correlated with the character of the rainfall ; heavy bursts of rain, followed by comparatively dry spells of short duration are characteristic of years in which the malarial incidence is low, whereas a constant drizzle with very few heavy falls of rain is always related to an increase in the malaria rate.

Fourteen species of Anophelines were found, all of which were noticed in a previous list [*R.A.E.*, B, xviii, 30]. *Anopheles culicifacies*, Giles, was found in one garden only and no adults were taken, but the rainfall was irregular and much below the average, so that this species may be more prevalent in a normal year [*cf.* xix, 165]. *A. minimus*, Theo., was found in clear water, slowly running or stagnant, exposed to sunlight or only lightly shaded, with grassy edges. Water containing much silt, decaying vegetable matter or iron bacteria was free from this species. Of 1,221 adults of *A. minimus* caught in nature, 1,219 were taken in dwellings and only 2 in cowsheds. Of the other species found 50 per cent. were taken in cowsheds. *A. aconitus*, Dön., has been found to be a natural carrier of malaria in other parts of the world, but in Assam it shows a predilection for bovine blood. The 2,144 adults caught were dissected, but only *A. minimus* was found to be infected, 38 individuals showing infection of the salivary glands and 26 infection of the gut. The highest number of oöcysts found in the gut was 178. The highest rate of infectivity occurred in October, with a slight decrease in November and a marked fall in December. It is thought that when the temperature reaches a minimum of 60° F., either the infected mosquitos do not live long enough to allow the sporozoites to develop, or development is arrested in the mosquito by adverse conditions, either local or climatic. Humidity, either relative or absolute, is not a factor limiting infectivity in Anophelines in Assam. A Nematode, probably a species of *Mermis*, was found in *Anopheles vagus*, Dön.

Puri (I. M.). **Larvae of Anopheline Mosquitoes, with full Description of those of the Indian Species.**—*Ind. Med. Res. Mem.*, no. 21, vi+228 pp., 47 pls., 5 pp. refs. Calcutta, June 1931. Price *Rs.* 11–8–0 or 15*s.* 4*d.*

The larvae of all the Anopheline mosquitos so far recorded from India are described and compared with those of some of the species occurring in other countries. The first part of the paper deals with the bionomics and external morphology of Anopheline larvae in general and the technique used in preserving and mounting larvae and their moults. The classification of Anopheline mosquitos based on larval characters is also discussed. In the second part keys are given for the identification of the full-grown larvae, and the external morphology of each species is described in detail. In many cases, brief notes on the habitat and references to previous descriptions are also given.

Manalang (C.). **Malaria Transmission in the Philippines, II. Infection of *Anopheles funestus* Giles (*minimus*) with Notes on its Density, probable Range of Flight, and larval Control.**—*Philipp. J. Sci.*, xlv, no. 3, pp. 367–379, 1 map, 12 refs. Manila, 1931.

Further investigations on *Anopheles minimus*, Theo., in the Philippines [*cf. R.A.E.*, B, xvii, 64] were carried out from January 1928 to May 1930 in an area in which was a temporary labour camp. As the locality was malarious, larval control by means of Paris green [*loc. cit.*] and quinine prophylaxis were instituted at the opening of the camp in 1927. From March onwards the adults were captured in a small wire screen cage baited with a man sleeping under a mosquito net. The doors of the cage were left open all night and closed in the early morning.

The trap was situated in a valley not far from a stream in the centre of the area, with a radius of 1 mile, that was being treated with Paris green. The advantage of this method of capture over exposure of the body or limbs of the collectors [*loc. cit.*] is that the collector does not contract malaria, the personal equation is reduced to a minimum, the catching is easier as there is less chance of escape, and the collection, being made from a circumscribed fixed area, is a reliable index of mosquito density and reveals the efficiency of larval control.

The object of larval control is to reduce the density of the transmitting mosquitos as much as possible below the effective number in the locality. This number is variable and is inversely proportional to the number and accessibility to the mosquito of suitable gametocyte carriers. In the area under consideration an effort was made to determine if the economic radius (1 mile) of control with Paris green was effective in reducing the density of *A. minimus* so that those systematically caught during a reasonable period would no longer show infection. Examination of the monthly trap catches shows a distinct decrease in their density from November 1928, after 10 months trapping, a period apparently too long for it to have any relation to larval control, which was begun in 1927. The reduced catches continued throughout 1929 and during the five months of 1930. It thus appears that the decrease in number was a natural phenomenon ; a similar decrease has been observed in two other places under larval control. The longest period during which adults of *A. minimus* were kept alive under artificial conditions was about one month.

A record of the weekly number of larvae caught at five definite stations on streams in the controlled area showed that they were practically absent at times and invariably less numerous than in areas beyond the limits of control. The larvae collected were few during the period of high adult catches, and relatively many in the latter half of 1929 and in 1930 when the adult catches were low [*cf. R.A.E.*, B, xix, 71]. It is therefore probable that most of the adults caught in the trap had migrated from their distant breeding-places into the controlled area, and that the range of flight of *A. minimus* is more than a mile. In two cases malaria was apparently contracted by the bites of this mosquito from human carriers living at a distance of about 1½ miles. The radius of larval control will therefore be extended to about 2 miles.

Dissections showed constant infection in the mosquito from January 1928 to June 1929, the rate varying from 0·6 to 7·7 in a month (stomach and salivary gland infections combined), but after this, except for one infected mosquito in August 1929 and one in December, the findings were negative. The average monthly catch was 338 during the 20 months when findings were positive and only 36 during the 9 negative months. The infectivity survey of mosquitos caught is useful in evaluating anti-malarial measures when the population is inconstant, and periodical blood surveys are unreliable.

STRICKLAND (C.). **On the Anophelines** *separatus*, *hunteri*, **and** *snijdersi*. —*Geneesk. Tijdschr. Ned.-Ind.*, lxxi, no. 8, pp. 770–775, 7 refs. Batavia, 15th July 1931.

Specific differences, particularly in the male genitalia, distinguishing *Anopheles hunteri*, Strick., from *A. separatus*, Leic., with which it had been considered identical [*R.A.E.*, B, ix, 73], are described, as well

as the larval characters of the two species. The form described by W.F.R. Essed from the Riouw Archipelago [xvi, 217] is considered to be *A. hunteri*, and *A. snijdersi*, Swell., to be *A. separatus*. S. R. Christophers and Essed both agree with the author's conclusions.

DE MEILLON (B.). **Illustrated Keys to the full-grown Larvae and Adults of South African Anopheline Mosquitos.**—*Pub. S. Afr. Inst. Med. Res.*, no. 28, pp. 277–375, 40 pls. Johannesburg, September 1931.

The key to the larvae includes all species of *Anopheles* recorded from South Africa, with the exception of *Anopheles jacobi*, Hill & Haydon, the larva of which is unknown, and *A. pharoensis*, Theo., *A. argenteolobatus*, Gough [*R.A.E.*, B, xvii, 128] and *A. pitchfordi*, Giles, of which no specimens were available to the author, the last-named being omitted from the key to the adults for the same reason. *A. squamosus* var. *cydippis*, n., is described on larval characters from Zululand and the Transvaal. The adult is indistinguishable from the typical form. This larva was previously described as that of *A. jacobi*.

A brief account is given of the methods of examining and preserving larvae.

NIESCHULZ (O.) & BOS (A.). **Einige Versuche mit überwinternden Exemplaren von** *Culex pipiens*. [A few Experiments with hibernating *C. pipiens*.]—*Zbl. Bakt.*, (2) lxxxiv, no. 15–18, pp. 364–368, 7 refs. Jena, 10th August 1931.

Experiments carried out in Holland in January–March 1931 with hibernating females of *Culex pipiens*, L., confirmed previous observations [*R.A.E.*, B, xiv, 154; xviii, 9, 252], and produced results conflicting with Roubaud's theory of obligatory asthenia in this and other mosquitos [xi, 162; xiv, 123; xvii, 108]. Mosquitos transferred from a cold cellar to a warm room resumed activity, which increased with the loss of the reserve of fat. Whereas only about 9 per cent. could be induced to feed on a fowl when freshly captured, nearly 57 and over 90 per cent. took a blood meal after having been kept for three and six days, respectively, at 26–28° C. [78·8–82·4° F.]. At this temperature the mosquitos did not survive longer than six days. Reactivation occurred at a lower rate at about 20° C. [68° F.], 56·9 per cent. of the mosquitos feeding in six days, and in one instance 84·5 per cent. in five days. They could be induced to feed during the day by covering the fowl with a box, but only 30 per cent. did so, as compared with 90 that fed during the night. Temperature seemed to have no effect on the feeding of starved mosquitos, as about 84–96 per cent. of those taken into a cold cellar at 10–12° C. [50–53·6° F.] after six days fasting in a warm room fed readily. Some were kept for two days in the cellar before being fed, showing that the act of feeding is not directly provoked by high temperature, but is the result of the need to satisfy hunger, even under conditions when normally a winter rest would take place. Mosquitos that had taken a blood meal readily oviposited, and the resulting larvae developed normally at an average temperature of 26·5° C. [79·7° F.] and gave rise to adults.

ROSSARO (G.). **Sull'Anofelismo senza Malaria nel commune di Brescello.** [Anophelines and the Absence of Malaria in the Commune of Brescello.]—*Igiene moderna*, xxiv, no. 7, p. 199, 1 map. July 1931. (Abstract in *Bull. Inst. Pasteur*, xxix, no. 18, p. 891. Paris, 30th September 1931.)

The Commune of Brescello, North Italy, is not malarious, though in certain areas *Anopheles maculipennis*, Mg., and *A. bifurcatus*, L., are very abundant, particularly the former. The author attributes this to the abandonment of rice culture and the keeping of domestic animals under cover. Numerous Anophelines taken in animal quarters show a slight morphological difference from those collected in malarious areas in Sardinia, particularly in respect of the maxillary armatures.

[PERFIL'EV] PERFILIEW (P.). **Zur Frage über die vergleichende Anatomie von** *Anopheles*. [On the Question of the comparative Anatomy of *Anopheles*.]—*Mag. Parasit. Mus. zool. Acad. sci. U.R.S.S.*, no. 1, pp. 75–96. 1930. (With a Summary in German.) (Abstract in *Bull. Inst. Pasteur*, xxix, no. 18, p. 892. Paris, 30th September 1931.)

This is a comparative study of the internal anatomy (mouth-parts, digestive tract and male and female genitalia) of *Anopheles maculipennis*, Mg., *A. bifurcatus*, L., *A. plumbeus*, Steph., *A. hyrcanus*, Pall., *A. superpictus*, Grassi, and *A. pulcherrimus*, Theo.

COSSIO (V.). **Observaciones sobre el** *Aëdes aegypti* (*Stegomyia*), **mosquito de la fiebre amarilla, en Montevideo.** [Observations on *A. argenteus*, the Yellow Fever Mosquito in Montevideo.]—*Bol. Cons. nac. Hig. Uruguay*, Montevideo, January 1931. (Abstract in *Bull. Inst. Pasteur*, xxix, no. 18, p. 895. Paris, 30th September 1931.)

Aëdes argenteus, Poir. (*Stegomyia aegypti*, auct.) is very abundant in Montevideo, breeding particularly in small collections of water that shows an alkaline reaction. The females bite at comparatively low temperatures (15° C. [59° F.] in nature and 14° C. [57·2° F.] experimentally). Hibernation takes place in the larval stage. The author is directing work towards modification of the hydrogen-ion concentration of the water in the breeding-places to render them unfavourable to larval life.

CLARK (H. C.) & DUNN (L. H.). **Experimental Efforts to transfer Monkey Malaria to Man.**—*19th Rep. Med. Dept. United Fruit Co. 1930*, pp. 55–60, 2 refs. Boston, Mass. [1931.]

An account is given of unsuccessful attempts to transmit malaria in Panama from naturally infected red spider monkeys (*Ateles geoffroyi*) to man by inoculation and by the bites of mosquitos, using *Anopheles albimanus*, Wied., *A. tarsimaculatus*, Goeldi, *A. argyritarsis*, R.-D., and *A. pseudopunctipennis*, Theo. Two monkeys (*Ateles dariensis* and *Cebus capucinus imitator*) that were inoculated as controls developed acute attacks of malaria after 11 days. Dissections of mosquitos three weeks after feeding on infected monkeys revealed parasites in the glands of *A. tarsimaculatus* (2 out of 18) and *A. albimanus* (1 out of 7) and gave negative results in the case of *A. pseudopunctipennis* (11) and *A. argyritarsis* (4).

Symes (C. B.). **Report on Anophelines and Malaria in the Trans-Nzoia District.**—*Kenya & E. Afr. Med. J.*, viii, nos. 3–4, pp. 64–77, 108–121, 3 graphs, 4 refs. Nairobi, June-July 1931.

An Anopheline survey was carried out in the Trans-Nzoia District of Kenya Colony during the period from December 1928 to November 1929, on estates where malaria and blackwater fever were prevalent. Of the 15 species of *Anopheles* recorded only *A. gambiae*, Giles (*costalis*, Theo.) and *A. funestus*, Giles, appear to be concerned in the transmission of malaria, although a few adults of *A. transvaalensis*, Cart., *A. christyi*, Newst. & Cart., *A. mauritianus*, Grp., and *A. marshalli*, Theo., were also captured in huts or tents. Definite proof of the feeding habits of the first two species was thought necessary, since in many huts they have equal opportunities to feed on man, fowls, goats and calves. Precipitin tests showed that both species prefer human blood, although *A. funestus* is not so restricted in its tastes as *A. gambiae*. In dissections carried out in April and May 1929, 7 out of 90 individuals of *A. gambiae* and 1 out of 15 individuals of *A. funestus* contained sporozoites. None of the other species was examined. The breeding-places of the various species and their seasonal prevalence are discussed. The intensity of adult infestations varies with the locality, and it is shown that it usually increases in almost direct ratio to the proximity of breeding grounds. The indiscriminate placing of labour lines and squatters' huts by the side of rivers leads to a general increase in domestic mosquitos and a consequent rise in malarial infection. It is suggested that blackwater fever may be a manifestation of a super-infection of malignant tertian [*Plasmodium falciparum*] on quartan malaria (*P. malariae*) or *vice versa*. The usual recommendations are made for malaria control on estates in infected areas.

Anderson (D.). **Notes on Mosquito-borne Diseases in Southern Nigeria. A statistical Study in Anopheline Breeding Places.**—*J. Trop. Med. Hyg.*, xxxiv, no. 10, pp. 131–133. London, 15th May 1931.

Following a complete survey during the second half of 1930 of the water courses in the town of Abeokuta in south-western Nigeria, as a preliminary to making recommendations for drainage, the author has endeavoured to place his findings on the breeding-places of Anophelines on a statistical basis. From the results, which are tabulated, it is concluded that *Anopheles gambiae*, Giles, breeds in streams rather than ponds, prefers open to shaded water, has a slight predilection for muddy water, is unaffected by the nature of the surface, and is to be found where the banks are clear rather than in places where there is ground vegetation growing down into the water. *A. funestus*, Giles, on the other hand is equally prevalent in ponds or streams, but prefers swamp water. This may be due to its preference for vegetation growing in the water as opposed to clear-cut banks. It is unaffected by the nature of the surface or the cleanness or otherwise of the water, but it prefers shade. Clearing the bush near the water will therefore decrease the numbers of *A. funestus* to a great extent. If a swift current can be obtained by canalisation, both species will be adversely affected, but if the current is sluggish, *A. gambiae* will continue to thrive, especially if the water is muddy. *A. funestus*

will breed in slow-moving water in canals if these are not kept free from vegetation. The filling and draining of ponds will eliminate many breeding-places of *A. funestus* and to a less extent those of *A. gambiae.* Thus, in places where there is not much fall, canalisation, filling and bush clearing must be supplemented by periodic oiling. *A. marshalli,* Theo., was also present, but in numbers too small for deductions to be drawn.

Corson (J. F.). **Direct Infection of native Fowls with** *Trypanosoma rhodesiense.—J. Trop. Med. Hyg.,* xxxiv, no. 8, p. 109, 2 refs. **A Note on experimental Infection of Guinea-fowl and Francolin with** *Trypanosoma rhodesiense.—T.c.,* no. 10, p. 133. **Hyrax as a possible Reservoir of** *Trypanosoma rhodesiense.—T.c.,* no. 14, pp. 213–214, 1 ref. London, 15th April, 15th May, 15th July 1931.

In Tanganyika Territory five native fowls, a guinea-fowl and four francolins were inoculated with *Trypanosoma rhodesiense,* and although trypanosomes could not be found by examination of blood from these birds, infection was transmitted by subinoculation to white rats from two fowls, one francolin and the guinea-fowl. The health of the fowls did not appear to be affected during about two months' observation. Although it is now generally believed that sleeping sickness is spread through the tsetse-fly chiefly from man to man, and that lower animals play at most a minor part, the importance of an animal reservoir is not in the frequency with which infection can spread from animal to man, but in the possibility that a single transmission may be the starting point of an outbreak. *Glossina morsitans,* Westw., has been reported to feed on birds [*R.A.E.,* B, xii, 161]. Fowls are kept in nearly all native villages, and francolins, guinea-fowl and doves are common. The common rat in many rural areas is a field rat that enters houses and is seen in considerable numbers during the day as well as at night.

Sixteen hyrax, the common " rock rabbit " of Tanganyika Territory, were inoculated with *T. rhodesiense* and all became infected, trypanosomes being observed in blood films. In one case only were posterior-nuclear forms noticed. Eight of the animals remained in apparently fairly good health for more than a month. Subinoculations into white rats produced infection, with the appearance of posterior-nuclear forms. Tsetse-flies experimentally fed on caged hyrax, and these animals are often seen in considerable numbers on rocky hills in the daytime, especially in the late afternoon and evening, the time when *Glossina morsitans* and *G. swynnertoni,* Aust., attack man readily. It therefore seems probable that they also feed on this animal. As hyrax are so susceptible to infection with *T. rhodesiense,* the possibility of their serving as a reservoir in sleeping sickness areas should be further investigated.

Adams (A. R. D.). **The Action of various Sera,** *in vitro,* **on the Gut and Salivary Gland Forms of** *T. rhodesiense* **and** *T. gambiense* **from** *Glossina palpalis.—Ann. Trop. Med. Parasit.,* xxv, no. 2, pp. 299–311, 4 refs. Liverpool, August 1931.

A technique is described whereby the action of sera on the gut and salivary gland forms of several strains of *Trypanosoma rhodesiense* and a single strain of *T. gambiense* from experimentally infected individuals

of *Glossina palpalis*, R.-D., was studied *in vitro*. It was found that fresh sera from a number of mammals (including man), birds and reptiles, rapidly destroyed the gut forms, but that when their haemolytic complement was removed their trypanocidal powers disappeared. The same sera exerted no lytic action on the salivary gland forms, which are thus shown to differ fundamentally from the gut forms; if this were not the case, the infection of mammals by the salivary gland forms would be difficult to explain. Examination of blood from recently fed individuals of *G. palpalis* showed that within 10 minutes of feeding the activity of the haemolytic complement of the ingested material had disappeared. The presence of an anti-complementary substance was demonstrated in saline emulsions of the mid-intestines, and to a less extent in those of the salivary glands of unfed flies, and it is probably due to this substance that infected flies are not sterilised by subsequent feeds of normal blood containing the haemolytic complement.

Blacklock (D. B.) & Lourie (E. M.). **The Demonstration of viable Leishmania in the Faeces of experimentally infected Bed-bugs.**—*Ann. Trop. Med. Parasit.*, xxv, no. 2, pp. 359–368, 1 fig., 12 refs. Liverpool, August 1931.

Experiments are described which demonstrate that viable forms of *Leishmania tropica*, *L. donovani*, *L. infantum*, *L. brasiliensis* and *Herpetomonas culicidarum* can be passed in the faeces of individuals of *Cimex lectularius*, L., infected by feeding on cultures. *L. tropica* was observed up to 35 days after the infecting feed.

Beeuwkes (H.) & Hayne (T. B.). **An experimental Demonstration of the Infectivity with Yellow Fever Virus of *Aëdes aegypti* captured in an African Town.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxv, no. 2, pp. 107–110. London, August 1931.

In view of the difficulty of the clinical identification of mild cases of yellow fever, which undoubtedly occur constantly in endemic areas of West Africa, it was thought that the presence of the active virus might be demonstrated in *Aëdes argenteus*, Poir. (*aegypti*, auct.) caught in various regions and the endemic areas detected in this way. Two experiments are described in which large numbers of *A. argenteus* taken in a town in Nigeria that had recently experienced an epidemic of yellow fever were allowed to feed on normal monkeys (*Macacus rhesus*), and later those that remained alive were emulsified and injected subcutaneously into healthy monkeys. Positive results were obtained only by injection in the first experiment. This and the negative results obtained with a much larger number of mosquitos in the second experiment indicates that the number of virus carriers must have been exceedingly small. This may be explained by the fact that a considerable percentage of the population of the town was probably immune. Large numbers of mosquitos have also been tested from another town where the disease is believed to be endemic, but the results have again been negative. In spite of the positive results obtained in the first experiment, the chances of capturing infected mosquitos appear to be remote, and it seems, therefore, that this measure does not constitute a satisfactory aid in demonstrating or confirming the existence of active infection in any area.

PEÑA CHAVARRÍA (A.), SERPA (R.) & BEVIER (G.). **La epidemia de fiebre amarilla en el Socorro (Colombia) 1929.** [The Yellow Fever Epidemic in Socorro, Colombia, in 1929.]—*Med. Paises calidos*, iv, nos. 3–4, pp. 217–235, 315–326, 4 maps, 23 refs. Madrid, 1931.

Records of yellow fever in Colombia are reviewed. In 1929 an epidemic occurred in the district of Socorro where *Aëdes argenteus*, Poir. (*aegypti*, auct.) was common. An account is given of the campaign undertaken against this mosquito, which followed the usual lines and resulted in controlling the epidemic.

SCHÜFFNER (W.), DINGER (J. E.) & SNIJDERS (E. P.). **Immuniseeringsmogelijkheden bij gele koorts.** [Possibilities of Immunisation in Yellow Fever.]—*Versl. Afdeel. Natuurk. Dl.*, xxxix, no. 8, pp. 155–156, in *Proc. Kon. Akad. Wetensch. Amsterdam*, xxxiii. Amsterdam, 1930.

Bonne has suggested that the mildness of yellow fever in the native population of Dutch Guiana may be due to previous infection with dengue. Moreover, it has been observed in Amsterdam that young monkeys (*Macacus cynomolgus*) from the Netherlands Indies always contracted fatal infection with yellow fever, whereas older individuals were only slightly susceptible. Dengue is universal in the Netherlands Indies and may be a factor in the absence of yellow fever there. In experiments in Amsterdam, *Aëdes argenteus*, Poir. (*aegypti*, auct.) and *A. albopictus*, Skuse, obtained from Sumatra, where they had fed on dengue cases, transmitted typical dengue to volunteers, but the infection was slight in an individual who had suffered a mild attack of yellow fever in the preceding year. In an experiment with *M. rhesus* it appeared that immediately after an attack of dengue there is a strong relative immunity from yellow fever. It was shown that *A. albopictus*, which is common in the Netherlands Indies, is able to harbour the yellow fever virus, but the infection transmitted by it is less regular and severe than with *A. argenteus*. Low temperature appears to effect the virus of yellow fever in *A. argenteus*. Numbers of this mosquito, after they had produced fatal infections, were accidentally left for some days at 16° C. [60·8° F.]. Monkeys afterwards bitten by them did not die, but were rendered immune from inoculation with infective virus. Though results with monkeys are not necessarily applicable to man, this may prove to be a method of immunising against yellow fever.

SINTON (J. A.). ***Phlebotomus stantoni* Newstead, 1914 and some other Siamese Sandflies.**—*Ind. J. Med. Res.*, xix, no. 1, pp. 99–106, 1 pl., 11 refs. Calcutta, July 1931.

During December 1930, *Phlebotomus stantoni*, Newst., *P. bailyi* var. *campester*, Sinton [*R.A.E.*, B, xix, 132] and *P. squamipleuris*, Newst., were collected in Siam, from which country no sandflies have apparently been previously recorded. No specimens of *P. stantoni* appear to have been taken since it was first described [iii, 11], and as the original brief description left considerable doubt as to whether or not this sandfly was identical with *P. argentipes*, Ann. & Brun., a re-description of the female is given, with a table showing the characters distinguishing the two species. The male is unknown. *P. philippinensis*, Mnlg. [xviii, 146] closely resembles *P. stantoni*, but the synonymy of these species cannot be determined until the male of the latter is available.

Sinton (J. A.). **Notes on some Indian Species of the Genus** *Phlebotomus*. **Part xxix.** *Phlebotomus arboris* **n. sp.**—*Ind. J. Med. Res.*, xix, no. 1, pp. 107–111, 1 pl., 2 refs. Calcutta, July 1931.

A collection of sandflies taken in August 1921 from cavities in large trees in Bengal was found to comprise individuals of *Phlebotomus zeylanicus*, Ann., *P. purii*, Sinton, and *P. arboris*, sp. n., of which no females were taken. The characters distinguishing these species and *P. sylvestris*, Sinton, *P. malabaricus*, Annan., and *P. squamirostris*, Newst., are given. The author states that *P. demeijerei*, Nitz. [*R.A.E.*, B, xix, 57] appears to be identical with *P. sylvestris*.

Pruthi (H. S.). **Preliminary Observations on the Influence of different Concentrations of Hydrogen Ions and Temperatures of Water on Mosquito Larvae** (*Anopheles subpictus*).—*Ind. J. Med. Res.*, xix, no. 1, pp. 131–135, 1 ref. Calcutta, July 1931.

The author describes experiments in Bengal in which larvae of *Anopheles subpictus*, Grassi, were subjected to different pH values in an effort to determine the conditions under which they will develop to maturity. Fifteen larvae were used in each experiment. At pH 3·5 no larvae pupated, at 5·2, 9 pupated and 2 became adult, at 7·4, 9 pupated and became adult, at 8·5, 5 pupated and 4 became adult, at 9, 1 pupated and became adult, and at 9·8, none pupated. Larvae were also subjected to constant temperatures of 28–30° C. [82·4–86° F.] and 32–34° C. [89·6–93·2° F.]. Although fewer larvae pupated and became adult at the higher temperatures, conditions are not comparable with those in the field, where temperature fluctuates at different times of the day and is invariably lower at night. These observations indicate that whereas larvae can live under wide ranges of temperature and of hydrogen-ion concentration, the conditions under which they become adult are much more limited. This is probably true for other factors of environment and suggests that larvae may be found where adults may never be produced.

Iyengar (M. O. T.). **Absence of Malaria in the Salt-water Lake Basin.**—*Ind. J. Med. Res.*, xix, no. 1, pp. 163–174, 2 pls., 1 map, 8 refs. Calcutta, July 1931.

To the east of Calcutta is an extensive inland saline water basin, known as Salt-water Lake, the villages in which were previously believed to be intensely malarious. A detailed malaria survey of this area shows, however, that it is almost entirely free from malaria, the gross spleen rate being about 0·3 per cent. The Anophelines found were *Anopheles subpictus*, Grassi, *A. vagus*, Dön., *A. hyrcanus* var. *nigerrimus*, Giles, *A. barbirostris*, Wulp, *A. fuliginosus*, Giles, *A. pseudojamesi*, Str. & Chd., and *A. minimus* var. *varuna*, Iyengar. *A. subpictus* was the predominant species in both larval and adult catches and comprised more than 90 per cent. of the total catch. It breeds in very large numbers in saline and brackish waters, especially those containing salt-water algae such as *Enteromorpha* and *Oscillatoria*. The other six species occur sparsely, since the fresh water collections in which they normally breed are not found in this area. The absence of malaria from the villages is attributable to the

scarceness of malaria-carrying mosquitos, and the enormous prevalence of *A. subpictus* in these villages seems to prove that it is not a vector in nature.

Differing views on the susceptibility of *A. subpictus* to infection with malarial parasites and the reasons that may prevent its transmitting them in nature are discussed from the literature, but the author concludes that it is extremely resistant to infection under natural conditions. Records of both experimental and natural infection in it have been due, in some cases at least, to its being confused with *A. ludlowi*, Theo., which, in spite of apparently suitable breeding-places, has not been found in the Salt-water Lake area.

Barraud (P. J.). **Notes on some Indian Mosquitoes of the Subgenus *Stegomyia*, with Descriptions of new Species.**—*Ind. J. Med. Res.*, xix, no. 1, pp. 221–228, 1 pl. Calcutta, July 1931.

It has recently been found that several Indian species of *Aëdes* (*Stegomyia*) have been confused with *A. albopictus*, Skuse, which has been shown experimentally to be capable of transmitting dengue and yellow fever. For this reason descriptions are given of the species concerned, *viz.*, *A. albopictus*, *A. pseudalbopictus*, Borel, *A. flavopictus*, Yam., *A. novalbopictus*, sp. n., and *A. subalbopictus*, sp. n., with notes on their distribution. *A.* (*S.*) *purii*, sp. n., is described from two males taken in northern Bengal.

Napier (L. E.) & Das Gupta (C. R.). **An Epidemiological Investigation of Kala-azar in a rural Area in Bengal.**—*Ind. J. Med. Res.*, xix, no. 1, pp. 295–341, 12 diag., 1 map, 5 refs. Calcutta, July 1931.

A detailed account is given of an investigation on the epidemiology of kala-azar in a typically rural area near Calcutta, carried out from 1925 to 1930. Although the observations made have not produced evidence definitely against any of the rival theories on the method by which the transmission of the disease occurs, all of them can be fitted into the hypothesis that the sandfly, *Phlebotomus argentipes*, Ann. & Brun., is the vector, and some of them add definite support to it. On the other hand, some of the observations fit equally well into the theory that transmission occurs by excretal contamination.

The predominance of the disease among Christians, as opposed to Hindus, is probably due to the fact that the former keep fowls and ducks indoors as well as out, and this is liable to foster a general insanitary state, which would encourage flies and other insects likely to cause infection of food and would also be conducive to the breeding of sandflies. This also applies to the observation that the incidence is higher amongst persons of a lower economic status.

The long intervals between the times of onset of cases occurring in the same house (and certain other observations) point to the existence of a carrier state, and it is suggested that the chronic lesions of post-kala-azar dermal leishmaniasis may act as a low-grade source of infection for many years. If this is correct, it is difficult to see how infection could be transmitted except by the aid of a biting insect. Moreover, it has been shown that *P. argentipes* can become infected after feeding on the common form of dermal lesions (depigmented patches) [*cf. R.A.E.*, B, xvi, 249].

Shortt (H. E.), Smith (R. O. A.) & Swaminath (C. S.). **Transmission of Kala-azar through** *Phlebotomus argentipes* **by the Oral Route.**—*Ind. J. Med. Res.*, xix, no. 1, pp. 351–352. Calcutta, July 1931.

Of two Chinese hamsters [*Cricetulus*] fed on emulsions of *Phlebotomus argentipes*, Ann. & Brun., infected by feeding on emulsions of liver and spleen from animals infected with kala-azar, one became infected with the disease. Negative results were obtained with three hamsters fed on emulsions of sandflies infected by feeding on cultures of *Leishmania donovani*.

Rybinsky (S. B.). **Further Observations on the malarial Curve in Kiev.**—*Zbl. Bakt.* (1, Orig.), cxxi, no. 7–8, pp. 409–413, 2 graphs, 16 refs. Jena, 11th August 1931.

Observations carried out in Kiev in 1926–29 in continuation of previous work [*R.A.E.*, B, xv, 137] showed a marked increase in the numbers of Anophelines in nature and dwellings in the beginning of June, the maximum being reached at the end of July; a decrease takes place at the beginning of September, hardly any mosquitos being found in November outside hibernation quarters. The time of the malarial infection of man is the end of summer and beginning of autumn. A gradual change in the curve of the total number of malaria cases was noticed, as instead of two rises, at the end of spring and the end of summer, only the spring rise occurred; there was a marked decrease in the number of severe attacks and a gradual disappearance of the rise of the curve in the autumn. This change is explained by a weakening of the virulence of the malarial parasite. The divergence in time between the presence of the maximum numbers of Anophelines in nature (July–September) and the occurrence of primary cases of malaria in the spring (April–May) confirms the theory of Korteweg [*R.A.E.*, B, x, 20; xviii, 52] that a long latency of primary malaria occurs in northern countries.

Nieschulz (O.), Bos (A.) & Tarip. **Uebertragungsversuche mit Geflügelpest und** *Stegomyia aegypti*. [Transmission Experiments with Avian Plague and *Aëdes argenteus*.]—*Zbl. Bakt.* (1, Orig.), cxxi, no. 7–8, pp. 413–420, 5 refs. Jena, 11th August 1931.

A detailed account is given of laboratory observations carried out in Utrecht in 1930 and 1931 to determine whether *Aëdes argenteus*, Poir. (*Stegomyia aegypti*, auct.) is concerned in the transmission of poultry typhus [*cf. R.A.E.*, B, xii, 199]. Intramuscular injections into fowls of macerated mosquitos showed that they harboured the virus only for a period of four days (in one instance six). Mosquitos did not transmit the disease from infected to healthy fowls either directly (by interrupted feeding) or after an interval of three or five days.

Kritschewski (I. L.) & Dvolaitskaya-Barischewa (K. M.). *Ornithodorus papillipes* **als Ueberträger von Spirochäten des Rückfallfiebers unter experimentellen Bedingungen.** [*O. papillipes* as Vector of the Spirochaetes of Relapsing Fever under experimental Conditions.]—*Zbl. Bakt.* (1, Orig.), cxxi, no. 7–8, pp. 421–432, 14 refs. Jena, 11th August 1931.

A detailed account is given of laboratory investigations carried out in Moscow in 1929 and 1930 with *Ornithodorus papillipes*, Bir., and

relapsing fever spirochaetes. The technique of the experiments, in which only adult ticks from Uzbekistan were used, is described, and the literature on the transmission of the various spirochaetes by ticks is briefly reviewed. In experiments with *Spirochaeta recurrentis* (*obermeieri*), no infection was produced in mice by subcutaneous injections of a suspension of crushed ticks that had fed on diseased animals 2, 3, 9 and 20 days previously, but this may have been due to shortness of the period, as infection was produced by the bites of ticks that had been artificially infected 109 and 175 days previously, though when the intervals were 77, 91 and 142 days, the results were negative. Infection with *S. usbekistanica* and *S. hispanica* var. *marocana* was produced in mice by inoculation of suspensions as well as by the bites of the ticks, the intervals between the feeds on diseased and healthy animals being 90 days in the case of *S. usbekistanica* and 137 in that of *S. hispanica*. These experiments have proved that ticks, having acquired infection in the adult stage, are capable of transmitting it by bite [*cf.* *R.A.E.*, B, xix, 18].

No transmission of *S. duttoni* was secured either by the injection of suspensions or the bites of *O. papillipes*.

NIESCHULZ (O.). **Ueber Luftfeuchtigkeit in Insektenzuchtzimmern.** [On the Humidity of the Air in Rooms used for Insect Breeding.]—*Zbl. Bakt.* (1, Orig.), cxxi, no. 7–8, pp. 519–520. Jena, 11th August 1931.

A simple method is described for maintaining atmospheric humidity in rooms used for breeding ticks and insects. A jet of water is directed through a fine rose upwards against a convex tin plate fixed at half the height of the room. Some of the water that strikes the plate is distributed into the room in the form of a fine mist ; the water that runs off the plate passes through a grating in the floor. In this way a humidity of 60–70 per cent. was easily obtained at temperatures of 26–28° C. [78·8–82·4° F.]. This is of special value in cases when the species requires more moisture than can be provided in the breeding dishes. On the other hand, even for species that do not need excessive moisture, it is better to maintain the humidity of the air than keep the insects in damp dishes, as in the latter case they are often infested by fungi.

Ticks and Tick Eradication.—*Bull.* [*Dept. Agric.*] *Vet. Dept. Kenya*, no. 13 of 1931, 16 pp. Nairobi, 1931.

In this bulletin, which is compiled for the use of stockowners, brief notes are given on the morphology and life-history of ticks in Kenya, and the diseases of domestic animals that they transmit [*cf.* *R.A.E.*, B, xix, 177]. The most practical and efficient means of reducing infestations is by dipping and hand-dressing, combined with such measures as efficient fencing, organised rotational grazing of pasture, etc. On farms heavily infected with African coast fever, the mortality can usually be checked by dipping the cattle every 3 or 5 days and hand-dressing regularly such parts as the insides of the ears, the tip of the tail, etc., from which the hair should be first clipped [xviii, 180]. The dressing mixtures recommended are equal parts of axle grease and kerosene, one part of tobacco extract to 5–6 of oil, or one part of solignum to 5 of oil ; any cheap oil, such as crude engine oil or oil from the sump of a motor car, may be used. Some ticks can

live without a host for 15–20 months, and theoretically if all cattle were removed from an infested area, all ticks should have died out by the end of 18–24 months. Actually this does not take place on account of the movement of small ground game that cannot be excluded by ordinary fencing. However, in the case of African coast fever, it is known that an infected nymph loses its infectivity after feeding on an animal not susceptible o the disease, and no cattle that have recovered from it have been known to infect ticks, so that the complete absence of non-immune cattle from an infected area for 18–24 months should eliminate the infection in the ticks. The dips recommended are similar to those previously noticed [ix, 84], the proportions of sodium arsenite (80 per cent. arsenious oxide), soft soap, and kerosene to 400 gals. of the dip being 4 lb., 3 lb. and 1 gal. for the 3 day dip, 8 lb., 5½ lb. and 2 gals. for the 5–7 day dip, and 12 lb., 7 lb. and 2¼ gals for the 10–14 day dip. Instructions for mixing the dips are given. The dipping fluid should be maintained at standard strength, as " scalding " of the skin, especially in calves, will occur if it is too strong and ticks will not be destroyed if it is too weak ; the strength may be tested by using an " iodometer," a simple apparatus which is briefly described. The usual precautions necessary when dipping cattle are given, with notes on the symptoms and treatment of arsenical poisoning, and the lay-out, etc., of the dipping plant.

Matheson (R.), Brunett (E. L.) & Brody (A. L.). **The Transmission of Fowl-pox by Mosquitoes, Preliminary Report.**—*Poultry Sci.*, x, no. 5, pp. 211–223, 2 pls., 1 fig., 1 ref. Ithaca, N.Y., July 1931.

Fowl-pox is a serious disease of poultry in New York State. In further experiments on its transmission by mosquitos [*cf. R.A.E.*, B, xvii, 241 ; xix, 148] *Aëdes vexans*, Mg., was used. Details of the technique are given and the experiments are described. Fowl-pox was transmitted 2, 3, 9, 16, 17 and 27 days after the mosquitos had fed on lesions on the comb. It was also transmitted by mosquitos that had fed 3 and 9 days previously on raisins contaminated with fowl-pox virus, and by inoculating the comb with a suspension of crushed mosquitos fed 27 days previously on contaminated raisins. In two experiments the same mosquitos produced infection 2 days and 27 days after their infecting feed, being fed in the interim on moist raisins.

Wright (R.). **The Leg-louse of Sheep and its Control.**—*N.Z. J. Agric.*, xliii, no. 1, p. 55. Wellington [N.Z.], July 1931.

Linognathus (*Haematopinus*) *pedalis*, Osb., has recently been found on sheep in many different localities in New Zealand and is evidently increasing in numbers [*cf. R.A.E.*, B, iv, 111 ; vii, 179]. It is usually confined to the hairy parts of the leg and scrotum, but cases have been observed in which all the wool on the stomach has been densely infested. Its presence is readily detected by the characteristic brown appearance due to the large number of eggs deposited on the legs and adjacent locks of wool.

Papers noticed by Title only.

Martini (E.). **Ueber einige südamerikanische Culiciden.** [On some South American Culicidae (including six new species of Culicines).] —*Rev. Ent.*, i, fasc. 2, pp.199–219, 1 pl. S. Paulo, 15th July 1931.

da Costa Lima (A.). **Notas sobre Culicidae.** [Notes on *Mansonia* (*Taeniorhynchus*) spp.]—*An. Mus. nac. Hist. nat.*, xxxvi, pp. 359–368, 13 figs., 6 refs. Buenos Aires, 1931.

Teubner-Predmerski (E.). **Ein Beitrag zur Eiablage von** *Theobaldia annulata*. [Investigations on the Oviposition of *T. annulata*, Schr.]—*Z. angew. Ent.*, xviii, no. 1, pp. 191–192. Berlin, June 1931.

Cordero (E. H.). **La presencia en el Uruguay de dos especies de dipteros vulnerantes del género** *Phlebotomus*. [The Presence in Uruguay of two Species of *Phlebotomus*, *P. gaminarai*, Cord., Vols. & Cossio, and *P. cortelezzii*, Brèthes, with a discussion of hypopygial characters distinguishing them.]—*An. Fac. Med. Montevideo*, xv, pp. 690–698, 3 figs. Montevideo, 1930.

[Khodukin (N. I.)] Chodukin (N. J.) & [Sofiev] Sofieff (M. S.). **Revision der Mittelasiatischen Phlebotomi.** [A Revision of the Sandflies of Central Asia.]—*Arch. Schiffs- u. Tropenhyg.*, xxxv, no. 8, pp. 482–488, 3 figs. Leipzig, 1931. [See *R.A.E.*, B, xix, 172.]

Manalang (C.). **Three new Sandflies** [*Phlebotomus bigtii*, *P. dayapensis* and *P. torrechantei*, spp. n., all of the *minutus* group] **from the Philippines.**—*Philipp. J. Sci.*, xlv, no. 3, pp. 355–365, 3 figs. Manila, 1931.

Ingram (A.) & Macfie (J. W. S.). **New Zealand Ceratopogonidae** [including 6 new species].—*Ann. Trop. Med. Parasit.*, xxv, no. 2, pp. 195–209, 4 figs. Liverpool, August 1931.

Kröber (A.). **Die kleinen Gattungen der Dichelacerinae End. aus der südamerikanischen Region (Tabanidae).**—*Rev. Ent.*, i, fasc. 3, pp. 282–298, 11 figs. S. Paulo, 5th September 1931.

Kröber (O.). **Die** *Tabanus*-**Untergattung** *Gymnochela* **End. (Diptera, Tabanidae).**—*Zool. Anz.*, xcvi, no. 1–2, pp. 49–61, 9 figs. Leipzig, 1st September 1931.

Aubertin (D.). **Revision of the Genus** *Hemipyrellia* **Tns. (Diptera, Calliphoridae).**—*Proc. Zool. Soc. Lond.*, 1931, pt. 2, pp. 497–509, 8 figs., 14 refs. London, June 1931.

Clark (H. C.), Dunn (L. H.) & Benavides (J.). **Spirochaetosis in a wild Monkey of Panama,** *Leontocebus geoffroyi* **(Pucheran).**—*19th Rep. Med. Dept. United Fruit Co. 1930*, pp. 176–181, 5 refs. Boston, Mass. [1931.] [Abridged version of paper already noticed (*R.A.E.*, B, xix, 213).]

Mukerji (S.). **"Lacto-chloral": A new clearing and mounting Medium for the rapid Observations of the microscopical Structures of small Insects.**—*Ind. J. Med. Res.*, xix, no. 1, pp. 281–283, 7 refs. Calcutta, July 1931.

Saling (T.) & Kemper (H.). **Ueber die Wirkung des T-Gases (Aetox) auf verschiedene Warmblüter und Gliederfüssler, insbesondere über seine Eignung zur Vertilgung von Gesundsheits- und Vorratsschädlingen.** [On the Effect of T-Gas (a mixture of ethylene oxide and carbon dioxide) on various warm-blooded Animals and Arthropods, especially on its Application for the Control of Household and Stored Product Pests.]—*Z. Desinfekt.*, xxiii, no. 7, pp. 285–314. Dresden, July 1931. [For a briefer account see *R.A.E.*, A, xix, 461.]

Publications of the Insecticide Division. (A complete List from July 1, 1927 to June 30, 1931.)—9 pp., multigraph. Washington, D.C., U.S. Dept. Agric., Bur. Chemistry & Soils, 1931.

DE BUCK (A.) & SWELLENGREBEL (N. H.). **Das Vorkommen von zwei verschiedenen Rassen des** *Anopheles maculipennis,* **als Erklärung des Anophelismus sine Malaria in Niederland.** [The Occurrence of two different Races of *A. maculipennis* as an Explanation of Anophelism without Malaria in the Netherlands.]—*Verh. deuts. zool. Ges.*, xxxiv, pp. 225–230, 1 fig., 7 refs. Leipzig, September 1931.

This paper summarises investigations that have already been noticed [*R.A.E.*, B, xiv, 82; xv, 21, 145, 180; xvi, 242; xviii, 52, 228] on the morphological and biological differences between the two races of *Anopheles maculipennis*, Mg., in malarious and non-malarious districts in Holland.

BUCHMANN (W.). **Untersuchungen über die Bedeutung der Wasserstoffionenkonzentration für die Entwicklung der Mückenlarven.** [Investigations on the Importance of the Hydrogen-ion Concentration for the Development of Mosquito Larvae.]—*Z. angew. Ent.*, xviii, no. 2, pp. 404–417, 20 refs. Berlin, August 1931.

The behaviour of mosquito larvae in water of various pH values was studied, the water being acidified with hydrochloric acid or rendered alkaline with quick-lime. Hydrogen-ion concentration had little or no effect on the larvae of *Culex pipiens*, L., which were indifferent to pH values from 4·4 to 8·5–9. They died, however, at pH 2–4·4, and pH 9–10, being poisoned by the free mineral acids in the first case and by the free quick-lime in the second. The young larvae were killed immediately after hatching in water of pH 2–4·4 and 8·5–10. The females did not oviposit in acid water of pH 2–4·4. The larvae of *Aëdes sticticus*, Mg., *A. vexans*, Mg., and *A. caspius*, Pall., developed fully only in water between pH 6·5 and 8. While therefore *C. pipiens* cannot be combated in practice by rendering its breeding-places acid or alkaline, the strengths required being destructive to other animal and to plant life, this method may be tried against species of *Aëdes*.

[PAVLOVSKIĬ (E. N.).] **Павловский (Е. Н.). Poisonous Animals of the U.S.S.R. A Manual for Physicians, Naturalists and Students.** [*In Russian.*]—Demy 8vo, 202 pp., 79 figs., 40 refs. Moscow, Gosud. meditz. Izd. [State Med. Pub.], 1931. Price 3 r. 40 *kop.*, binding 60 *kop.*

In this handbook 40 pages (124–163) are devoted to an account of the effects on man of the bites and stings, urticating hairs, etc., of various insects, which are briefly described. Notes on their poisonous organs are given, and methods of treatment are indicated.

[PAVLOVSKIĬ (E. N.) & MESS (A. A.).] **Павловский (Е. Н.) и Месс (А. А.). Biological Observations on the blacklegged Malaria Mosquito**—*Anopheles plumbeus* **Hal. in the District of the Caucasian Mineral Water Springs.** [*In Russian.*]—*Mag. paras. Mus. zool. Acad. Sci. URSS.*, i, 1931, pp. 235–251, 3 pls., 9 refs. Leningrad, 1931. (With a Summary in German.)

In the course of investigations carried out in the northern Caucasus at intervals from August 1926 till October 1928, numerous larvae and pupae of *Anopheles plumbeus*, Steph., and *Aëdes* (*Finlaya*) *genicu-*

latus, Ol., were found in forests and parks in holes in trees containing stagnant water [*R.A.E.*, B, xvi, 37]. In the winters of 1926–27, hibernation occurred in the larval stage. Larvae of both species of various ages were present in hollows in November and December, and those of *A. plumbeus* pupated in May, the pupal stage lasting 3–4 days in the laboratory. No hibernating larvae were found in the winter of 1927–28, probably owing to the drying up of the water in the hollows in the autumn and a severe winter; the first larvae of *A. geniculatus* occurred at the end of April and those of *A. plumbeus* on 10th July. The authors conclude, therefore, that hibernation took place in the egg stage. In nature the development of the immature stages of *A. plumbeus* depends on temperature conditions and on the exposure of the tree hollows to the sun, the quantity of the water they contain, etc., so that the generations overlap. The larvae may survive in the débris at the bottom of the hollows after the water had evaporated. Their nutrition is briefly discussed; an analysis of the stomach contents showed that they consisted mainly of detritus. Though *A. plumbeus* was considerably less abundant than *A. geniculatus* and attacked man less frequently, it may play an important part in the spread of malaria in health resorts in the northern Caucasus, owing to the great number of breeding-places in the forests that are frequented by the public.

As a control measure, filling the hollows with earth or sand, with the addition of cement, is recommended.

[Pavlovskiĭ (E. N.).] **Павловский (Е. Н.). On the Distribution of Malaria Mosquitos in the District of Knyazhiĭ Dvor (Shimsk, Novgorod Region) in Connection with the Question of the Zoophilism of** *Anopheles maculipennis*. [*In Russian.*]—*Mag. paras. Mus. zool. Acad. Sci. URSS.*, ii, 1931, pp. 59–72, 1 map. Leningrad, 1931. (With a Summary in German.)

An account is given of investigations on the breeding-places of *Anopheles maculipennis*, Mg., carried out in the Novgorod Government. Larvae and pupae occurred in pits and wooden tubs containing water, along the banks of a river and in other natural collections of water where algae were present and the current was slow, though in some instances the water was polluted. None was found in brackish water even though other factors offered favourable breeding conditions. Observations were also made on the distribution of the adults of *A. maculipennis* in and near human dwellings. Engorged females were most numerous in sheds in which pigs, cattle and goats were kept. As, however, the mosquitos also occurred in inhabited houses and attacked man, though to a less extent than animals, they cannot be considered to belong to a definitely zoophilous race. Their numbers decreased considerably in early September.

Brug (S. L.) & Edwards (F. W.). **Fauna Sumatrensis. (Bijdrage Nr. 68), Culicidae (Diptera).**—*Tijdschr. Ent.*, lxxiv, no. 2–3, pp. 251–261, 1 map. Amsterdam, 1st September 1931.

This is a list of all the mosquitos recorded from Sumatra and the small islands adjoining it, showing their local distribution. The total number is 139, of which 25 belong to the genus *Anopheles*.

STRICKLAND (C.) & CHOWDHURY (K. L.). **The Anopheline Larvae of the Countries from India and the Orient to the Antipodes.**—Roy. 8vo, 36 pp., 21 pls., 30 refs. Calcutta & Simla, Thacker, Spink & Co., 1931. Price, *Rs.* 1·12.

This work forms a supplement to "The Anopheline Larvae of India, Ceylon and Malaya" [*R.A.E.*, B, xv, 185]. Its scope has been extended to include the whole of the Far East and the Australian region and to consider not only species but also varieties. An amended list of the species and varieties of Anophelines is given, with a key to the larvae which includes *Anopheles aitkeni* var. *britanniae*, n. The form of *Bironella* (*Anopheles*) *papuae*, Swell, found by R. Soesilo [xviii, 233] is considered to be a distinct species, for which the name *B. soesiloi* is proposed. A footnote states that Soesilo has recently discovered what is probably the adult male of this type of larva, the genitalia being very distinct from those of *B. papuae*.

SCHÜFFNER (W. A. P.), SWELLENGREBEL (N. H.) & CIUCA (M.). **Report of the Malaria Commission on its Study Tour in India (August 23rd to December 28th, 1929).**—C.H./Malaria/147, 77 pp., 46 figs., 40 refs. Geneva, League of Nations, August 1930. Price 3*s*.

SCHÜFFNER (W.). **Notes on the Indian Tour of the Malaria Commission of the League of Nations.**—*Rec. Malaria Surv. India*, ii, no. 3, pp. 337–347. Calcutta, September 1931.

This detailed account of the observations and conclusions of the Malaria Commission of the League of Nations is preceded by a brief review of the history of malaria research and prevention in India and a summary of the present situation by S. R. Christophers. In the first section notes are given on the general aspects of malaria in India and the organisation of anti-malarial work. The second section deals with the four main local problems as presented by malaria in urban districts (which is definitely related to one species of mosquito, *Anopheles stephensi*, List.), in the Punjab, in the Bengal delta and in the hill regions, each of which requires widely differing control measures. In the third section the training of staff and the anti-malarial measures in use are reviewed, examples are given of malaria control work carried out under urban and rural conditions, in certain agricultural, industrial and rural centres, and under local organisations. Research work is discussed, and the last section is devoted to the summary and conclusions.

The second paper is a résumé of the main points dealt with above.

SINTON (J. A.). **Reports on some short Malaria Surveys undertaken in Kathiawar.**—*Rec. Malaria Surv. India*, ii, no. 3, pp. 349–405, 4 diag. Calcutta, September 1931.

Brief investigations on malaria were undertaken in five areas in Kathiawar, Bombay Presidency, during April (1929), which is the driest season of the year and practically the least malarious, and the results, although incomplete, are recorded in view of the paucity of information on malaria in this part of India. In each case, information is given on the topography of the locality, the mosquitos encountered, the incidence of malaria and the anti-malarial measures recommended.

Chowdhury (K. L.). **Some Observations on the Hibernation and "Wintering" of Anophelines in the Punjab.**—*Rec. Malaria Surv. India*, ii, no. 3, pp. 407–421, 4 refs. Calcutta, September 1931.

Literature on the winter habits of Indian Anophelines and on the definition of hibernation and "wintering" is reviewed, "wintering" being described as retardation of development without complete cessation of activity. Research on this subject was undertaken in view of the possibility of attacking mosquitos at the time of their lowest density and so reducing expenditure on insecticides to a minimum.

The following is taken from the author's conclusions, which are based on field and laboratory observations undertaken at Karnal, Punjab, in the winter of 1930–31. The Anophelines found were *Anopheles fuliginosus*, Giles, *A. culicifacies*, Giles, *A. subpictus*, Grassi, *A. stephensi*, List., *A. listoni*, List., *A. hyrcanus* var. *nigerrimus*, Giles, *A. barbirostris*, Wulp, *A. pallidus*, Theo., *A. pulcherrimus*, Theo., *A. maculipalpis* var. *splendidus*, Koidz. (*indiensis*, Theo.), *A. maculatus*, Theo., and *A. gigas*, Giles. The first seven species are common and occur in large numbers in the most favourable season of the year, the next three are fairly prevalent and the last two are so rare that no studies could be made on them.

Of the first seven species only *A. subpictus* appears to hibernate, probably in the adult stage. This conclusion is supported by the fact that no larvae or eggs were found in winter, and its chances of survival in the egg stage are small. Laboratory experiments have shown that the adults die off rapidly as the nights become cooler. The eggs hatch even when the temperature is below 50° F., but the resulting larvae die in the early stages, and eggs kept on moist earth are not viable at the end of the winter. No hibernating individuals were found, probably owing to the inaccessibility of likely shelters (such as the enclosed ceilings of native huts).

The other six species have been found both as larvae and adults throughout the winter, the latter with fresh blood in their stomachs, but their numbers are greatly reduced owing to the high mortality at low temperatures and the retarded development of the larvae, which only continue to grow if the daily maximum of the atmosphere rises above 70° F. In the case of these species it would appear that the winter season can be covered by a single generation. Observations on the life-cycle of *A. fuliginosus* in winter showed that the maximum lengths of the stages were: egg 3 days, larva 68, pupa 7 and adult (estimated not observed) 21 days, a total period of more than three months. Search for the larvae and adults of *A. pallidus*, *A. maculipalpis* var *splendidus* and *A. pulcherrimus* was insufficient to warrant conclusions regarding these species, but it is believed that they behave like *A. fuliginosus* in winter.

Macdonald (G.) & Majid (Abdul). **Report on an intensive Malaria Survey in the Karnal District, Punjab.**—*Rec. Malaria Surv. India*, ii, no. 3, pp. 423–480, 1 graph, 10 refs. Calcutta, September 1931.

A detailed account is given of an intensive malaria survey carried out in the Karnal District of the Punjab during 1929–30. Regular collections of both larvae and adults were made in the villages and in the vicinity of Karnal City. *A. fuliginosus*, Giles, *A. maculipalpis*,

Giles, and *A. listoni*, List., appeared at the end of the monsoon, about the end of August or beginning of September, and were present until April or May, being most prevalent in autumn and spring. *A. culicifacies*, Giles, *A. subpictus*, Grassi, *A. pulcherrimus*, Theo., and probably *A. maculatus*, Theo., began to breed in the spring between March and May and continued throughout the hot season until the weather became cooler at the approach of winter, being most abundant during the monsoon period when breeding-places were most common. *A. hyrcanus*, Pall., *A. barbirostris*, Wulp, and *A. pallidus*, Theo., bred in large numbers at the end of August and the beginning of September but disappeared at the end of the year ; and *A. stephensi*, List., was prevalent from March to June, but only a few adults were caught after the beginning of the monsoon. The results of dissections indicate that *A. culicifacies, A. listoni* and possibly *A. maculipalpis* (1 infected in 26 dissections) are readily infected with malaria and that *A. fuliginosus* may be infected in small numbers. Of the other possibly important species, *A. stephensi* was found in numbers too small to form any conclusions and *A. maculatus* was not taken during the infectivity survey. *A. culicifacies* is considered the important vector in this region ; it occurs at the time of year when malaria is most prevalent and was continually found breeding in large numbers in close proximity to villages where malaria was severe. *A. stephensi* is not considered to be of practical significance, as it is only present in small numbers and breeds in the early part of the hot season before the transmission of malaria is possible. *A. listoni* may possibly be of subsidiary importance to *A. culicifacies* when it starts to breed at the end of the malaria season. The types of breeding-places are described. The most dangerous of these are canals, canal distributaries and seepages, ditches of running water, and masonry tanks used for storing water. The incidence of malaria in the various villages and the Anophelines found in each are discussed in detail.

Christophers (S. R.) & Puri (I. M.). **Species and Varieties of the** *funestus* **Series of** *Anopheles.*—*Rec. Malaria Surv. India*, ii, no. 3, pp. 481–493, 2 figs., 7 refs. Calcutta, September 1931.

The authors discuss the general characters of the group of Anophelines that are closely allied to *Anopheles funestus*, Giles, and consider the following to be specifically distinct: *A. funestus*, *A. listoni*, List., *A. aconitus*, Dön., *A. arabica*, Chr. & K.C., *A. minimus*, Theo., *A. varuna*, Iyen., and *A. filipinae*, Mnlg. [*R.A.E.*, B, xix, 5]. The features distinguishing the eggs, larvae and adults of the first three species and the larvae and adults of the others are described, with notes on the distribution of the species, brief indications of the types of water in which they breed, and a discussion of their classification.

De Meillon (B.). **A new South African Anopheline.**—*J. Med. Ass. S. Afr.*, v, pp. 482–483. Cape Town, 8th August 1931.

The female of *Anopheles listeri*, sp. n., is described. Larvae of this species, which have been described elsewhere [*R.A.E.*, B, xix, 229], have been taken in Natal and the northern Transvaal ; they were found in open, exposed pools in stream beds in association with those of *A. pretoriensis*, Theo., and *A. gambiae*, Giles.

Swellengrebel (N. H.), Annecke (S.) & De Meillon (B.). **Malaria Investigations in some Parts of the Transvaal and Zululand.**—*Pub. S. Afr. Inst. Med. Res.*, no. 27, pp. 245–274, 3 pls., 5 graphs, 2 maps, 9 refs. Johannesburg, July 1931.

In order to determine whether malaria control on the principle of species sanitation was possible in the Union of South Africa, a detailed investigation of the breeding-places of *Anopheles gambiae*, Giles, and *A. funestus*, Giles, was undertaken. Although *A. funestus* is well known as a stream breeder, the especial features of its habitat only became apparent from observations in the north-eastern part of the Transvaal. The larvae occur there in hill streams, along banks covered with grass or made up of grass roots hanging into the water, especially in backwaters where the current is not too strong. A certain amount of shade is preferred, but heavy shade, such as occurs along banks fringed with a dense growth of reeds, is as unfavourable as exposure to sunlight, where there is little vegetation. The water selected is clear and fresh, though sometimes a certain amount of decaying vegetable matter may be present. It practically never breeds in seepage areas along hillsides, or in swamps, either natural or artificial (rice-fields), in the course of hill streams, unless the reeds are cut down and the stream fairly well (but not too well) trained. Breeding rarely occurs in these swamps except at the edges, as the vegetation in the water is covered with iron bacteria and their sheaths, and wherever these are present no larvae are found. *A. funestus* does not occur in the standing portions of streams, though it may be prevalent a few yards away where the water is running. Finally this species disappears above a certain altitude (which in these observations was slightly above 3,000 ft., but may vary from place to place), although larvae of *A. longipalpis*, Theo., *A. natalensis*, Hill & Haydon, and *A. ardensis*, Theo., may still be abundant. It seems probable that it is prevented from breeding by the cold, as larvae are absent during the winter from collections of water where they are prevalent in summer.

A. gambiae breeds in small muddy pools with little or no vegetation and no shade, and it may occur in large numbers in half-dried puddles seething with tadpoles in which no other Anopheline is found, but it does not tolerate foul water and prefers small rainwater pools, freshly formed, that disappear in a few days unless replenished by repeated showers. In a country where so much of the land is covered with long grass, *A. gambiae* is attracted to road and roadside puddles and to the sunny, arid spaces cleared round dwellings. The dry low veldt of the western Transvaal appears to afford an exception to this rule, for although it holds good in areas far from rivers, *A. gambiae* continues to breed in the small pools formed in the edges of river beds in dry years when the rivers are low, even when there is no rain. There does not, however, appear to be any fundamental difference between the individuals dependent on rainr and those dependent on streams, for the water in the pools of the river bed is also constantly replenished, either by influx of water from the main stream or by slight changes in the level of the subsoil water. It is therefore concluded that both species are suited to species sanitation. A table is given showing the percentage, in each type of breeding-place, of the total number of larvae of all the species taken.

The assumption that *A. gambiae* is one of the only two vectors of malaria fits in remarkably well with epidemiological observations,

malaria being most prevalent in rainy years and persisting even in dry years along the banks of rivers. In general, unless this mosquito is very rare, its presence invariably entails an outbreak of the disease. The authors believe that in dry years the species manages to survive under very unsuitable conditions, though in numbers too small to cause outbreaks of malaria ; in the same way it survives the winter, although retarded development due to low temperatures is also a factor in this case.

The relation between breeding-places of *A. funestus* and the occurrence of malaria is not so marked, and it is not exceptional to find prolific breeding where there is little malaria. It was observed, however, that *A. funestus* is only found in dwellings in places where the disease occurs. On the other hand, where it may be supposed to be the principal vector, malaria is endemic, reappearing every season and, in some instances, continuing through the dry season.

During an infectivity survey, the following Anophelines were caught in an area among foothills : in native huts, 4 *A. rufipes*, Gough, 9 *A. pretoriensis*, Theo., 6 *A. gambiae* and 360 *A. funestus* (of which 44 out of 240 were infected) ; in European farms, 1 *A. maculipalpis*, Giles, 1 *A. pretoriensis* (infected) and 46 *A. funestus* (of which 6 out of 44 were infected) ; and outside dwellings, 1 *A. gambiae*, 7 *A. funestus*, 14 *A. rufipes* and 179 *A. pretoriensis* (of which 1 out of 110 was infected). In a low veldt area in native huts the numbers were, 1 *A. rufipes*, 1 *A. marshalli*, Theo., 53 *A. funestus* and 195 *A. gambiae* (of which 27 out of 161 were infected). Thus *A. gambiae* and *A. funestus* not only visit human habitations but stay there in considerable numbers. When these species occurred outside, no infections were found in them. *A. pretoriensis* is not considered likely to be a vector of practical importance, as it so rarely remains in houses. The high infection rate in human habitations may be partly explained by the absence of stables, precluding animals from attracting Anophelines. Observations indicated that even crescent carriers with one gametocyte per 1,500 leucocytes may infect Anophelines.

During the investigation at an altitude of 1,900–2,400 ft. a sudden drop in temperature occurred. *A. funestus* had been kept alive with ease for several days on sugar-water, and it completely digested a blood meal in 48 hours, but at the lowered temperature it showed a heavy mortality after 24 hours and black blood was still present in its stomach after 48. Moreover, the infection rate, which had been 18 per cent., subsequently dropped to 7·3. The vitality of *A. gambiae* was not affected by the cold weather, but its infection rate was reduced from 17·8 per cent. to 5·4.

Spleen surveys of the European, Indian and native population were undertaken, and the question of immunity and tolerance, both inherited and acquired, is discussed at some length.

MANALANG (C.). **Malaria Transmission in the Philippines. III. Density and Infective Density of** *Anopheles funestus*, **Giles. IV. Meteorological Factors.**—*Philipp. J. Sci.*, xlvi, nos. 1–2, pp. 47–59, 4 refs., pp. 247–255, 3 graphs, 4 refs. Manila, September & October 1931.

The first of these papers, which are in continuation of previous studies [*R.A.E.*, B, xix, 186, 227] is a reprint of the second part of one already noticed [xix, 51, 95]. In the second, data on natural malaria infection in *Anopheles minimus*, Theo. (*funestus*, auct.),

in two localities in the Philippines, collected from September 1927 to August 1929, are compared with meteorological records obtained from September 1929 to August 1930 in a locality about 6 miles distant. The indications are that a rise in the infectivity rate corresponds to an increase in rainfall, mean temperature and relative humidity, although infections are also present during the dry, cool and less humid months.

The differences in seasonal distribution of malaria transmission in the Philippines are probably explained by the fact that *A. minimus* breeds in both permanent and temporary waters. In localities where the breeding-places disappear during the dry months, breeding and a consequent increase in adult density occur during the rainy season, whereas in localities where breeding is limited to permanent streams, heavy rains flush out the larvae and there is a reduction in adult density and transmission.

Russell (P. F.). **A Method for feeding Blood Meals to Mosquitoes.—Male and Female. Preliminary Note.**—*Amer. J. Trop. Med.*, xi, no. 5, pp. 355–358, 2 figs. Baltimore, Md., September 1931.

A simple and effective method for feeding male and female mosquitos on blood is described. The adults are placed in a glass cylinder 3 ins. in diameter and 3 ins. high, covered at the top and bottom with 16-mesh cloth netting. The cylinder is placed in a glass Petri dish, and a sufficient quantity of mango juice is smeared on the top screen to attract the mosquitos without their being able to imbibe it. A second glass Petri dish is placed over the top of the cylinder while the blood meal is being prepared. About ten drops of blood (in the author's tests this was taken from a canary) are then added to 1 cc. normal saline, so that it is red. The mixture is distributed over the top screen by means of a small syringe, a toothpick being used to spread it, and the Petri dish is replaced. The mosquitos are allowed to feed at their leisure; both sexes of *Culex fatigans*, Wied., *Aëdes argenteus*, Poir. (*aegypti*, auct.) and *Anopheles ludlowi*, Theo., have imbibed blood in this way in the morning and afternoon. Of the individuals that were kept without food for 24 hours after emergence from the pupal stage, a high percentage fed. Dissection has revealed blood corpuscles in the midgut of both males and females, although at times some or all of the blood meal is drawn into the oesophageal diverticula. It has not been determined whether gametocytes present in blood fed to mosquitos in this manner will give rise to oöcysts and sporozoites, but a single, small oöcyst was found in the wall of the midgut of a male of *C. fatigans* 15 days after it had fed on the blood of a canary containing many gametocytes of *Plasmodium cathemerium*.

Russell (P. F.). **Dental Instruments for Mosquito Dissection.**—*Amer. J. Trop. Med.*, xi, no. 5, p. 359. Baltimore, Md., September 1931.

Certain dental instruments, such as nerve canal probes, have been found superior to the ordinary needles for dissecting mosquitos. They are not unduly expensive, do not corrode, are impervious to all ordinary laboratory solutions and retain their sharp points. Moreover, they are well-balanced, have comfortable handles, and their length facilitates dissections under the microscope.

Manalang (C.). **Origin of the irritating Substance in Mosquito Bite.**—*Philipp. J. Sci.*, xlvi, no. 1, pp. 39–45, 1 pl., 2 refs. Manila, September 1931.

The following is taken from the author's summary and conclusions: The salivary gland of a mosquito inoculated into the skin produced a typical bite reaction, contrary to Schaudinn's finding. His reaction using the diverticulum was confirmed in ten tests with the diverticula from females and three tests with diverticula from males, in which the organ was picked up on the point of a needle and inoculated by twenty light pricks on a fixed point in the skin. The irritation of a mosquito bite must, therefore, be due to the injection of the salivary gland secretion, the diverticular contents, or both, and is not solely of diverticular origin. Typical bite reactions were also obtained from parasites of the mosquito (sporozoa or fungus) and from other sources, such as the stomach, oesophagus, testes and ova. Varying degress of susceptibility in man to mosquito bites were demonstrated in six individuals.

Huff (C. G.). **The Inheritance of natural Immunity to** *Plasmodium cathemerium* **in two Species of** *Culex.*—*J. Prev. Med.*, v, no. 4, pp. 249–259, 2 figs., 6 refs. Baltimore, Md., July 1931.

Further studies on the susceptibility of individuals in a given species of mosquito to infection with malarial parasites [*R.A.E.*, B, xviii, 96; xix, 7] have been carried out, using *Culex pipiens*, L., and *C. fatigans*, Wied. (*quinquefasciatus*, Say) and *Plasmodium cathemerium*. The following are the author's conclusions: Selective breeding of *C. fatigans* has been shown to influence the percentage of individual females susceptible to *P. cathemerium*, a decrease following selection from uninfected females and an increase selection from infected ones. Susceptibility of *C. pipiens* to *P. cathemerium* behaved as a simple recessive Mendelian character. Some of the possible bearings of these findings upon Anophelines and malaria in man are discussed.

Stratman-Thomas (W. K.). **On the supposed Antagonism between Alfalfa and Malaria.**—*Amer. J. Hyg.*, xiv, no. 2, pp. 394–410, 1 diag., 13 refs. Baltimore, Md., September 1931.

For the greater part of fifteen years, the period covered by the official records, there has been an almost uninterrupted decline in the mortality from malaria in the delta section of the State of Mississippi, a region that had previously been notorious for its high death rate. This decline has occurred since the introduction of lucerne, and, in view of the alleged influence of leguminous plants on the incidence of malaria [*R.A.E.*, B, xvi, 26; xviii, 143, etc.], a survey was undertaken to determine the optimum conditions for the cultivation of lucerne and their relation to the epidemiology of malaria, in order that an accurate estimate might be made of the value of lucerne itself as a contributing factor.

It is concluded that although there is a positive correlation between the incidence of malaria and standing water, there is no apparent correlation between it and lucerne. Persons living adjacent to standing water and lucerne are not protected by the lucerne. Wherever a

decline in malaria coincides with the planting of lucerne, it is directly due to the proper drainage necessary to obtain the optimum conditions for the growing of the crop.

Shannon (R. C.) & Frobisher, jr. (M.). **A Comparison of the Effect of various Substances upon Larvae of** *Aëdes aegypti*.—*Amer. J. Hyg.*, xiv, no. 2, pp. 426–432, 2 refs. Baltimore, Md., September 1931.

In continuation of previous experiments [*cf. R.A.E.*, B, xix, 140], the toxicity of 52 substances at various dilutions was tested against *Aëdes argenteus*, Poir. (*aegypti*, auct.) by recording the maximum time required to kill five fourth-stage larvae, freed from excess water and placed in a tube containing about 10 cc. of the desired material. The results are tabulated. Of special interest is the rapid lethal action of creolin (a proprietary substance of the crude carbolic type, probably containing phenol, the cresols and related substances), which killed all the larvae in 25 seconds at a dilution of 1 per cent., and the relatively much lower larvicidal power of pure phenol, which took 10 minutes at the same dilution. Alum appears to be as effective as borax [*cf.* xvi, 142]. Either of these salts may be used in certain types of receptables used for storing water. They remain effective over long periods of time, are non-poisonous and obviate the necessity for an unsightly layer of oil.

Feng (Lan-Chou). *Anopheles hyrcanus* **var.** *sinensis* **Wied., Transmittor of** *Wuchereria* (*Filaria*) *bancrofti* **in Woosung District, Shanghai, China.**—*Amer. J. Hyg.*, xiv, no. 2, pp. 502–514, 1 pl., 1 map, 13 refs. Baltimore, Md., September 1931.

As *Anopheles hyrcanus* var. *sinensis*, Wied., is a suitable intermediate host for *Filaria* (*Dirofilaria*) *immitis*, a parasite of dogs in north China [*R.A.E.*, B, xix, 30], it was thought that it might also serve as the intermediate host of *Filaria* (*Wuchereria*) *bancrofti*, and this hypothesis was confirmed by the accidental discovery of microfilariae of the latter in two individuals of this mosquito in the vicinity of Woosung, near Shanghai. As elephantiasis and filariasis are common in the Woosung district, particularly in the country villages, a survey of mosquitos was undertaken to determine the rate of infection. The domestic mosquitos encountered were *Anopheles hyrcanus* var. *sinensis* and *Culex tritaeniorhynchus*, Giles, which were generally found in small dwellings in the country and on the outskirts of the town, and *C. pipiens* var. *pallens*, Coq., *Armigeres obturbans*, Wlk., and *Aëdes albopictus*, Skuse, which occurred principally in the central part of Woosung.

The following is taken from the author's summary: 16 per cent. of *A. hyrcanus* var. *sinensis* dissected were positive for filarial larvae, and in 16 per cent. of the infected individuals the larvae were mature. Of *C. pipiens* var. *pallens*, 13 per cent. contained larvae, of which none was in the infective stage. Larvae in the early stages of development were also observed in the other three species of mosquito. *A. hyrcanus* var. *sinensis* has also been found naturally infected in Soochow, and it is concluded that this species is an important natural carrier of *F. bancrofti* in Woosung and probably along the whole Yangtse Valley.

Tanner (W. F.). **Inspection of Ships for Determination of Mosquito Infestation.**—*Publ. Hlth. Rep.*, xlvi, no. 39, pp. 2306–2320. Washington, D.C., 25th September 1931.

In view of the recent occurrence of yellow fever in South America, a study was begun in 1929 on the prevalence of mosquitos on vessels arriving at the ports of New York and New Orleans from South and Central America and the West Indies. Eleven vessels were inspected on their arrival at New York, and 34 reports were received from fruit vessels entering New York and New Orleans. Details of the inspections and reports are given in an appendix. Of the 41 mosquitos submitted, only one specimen (caught at Havana) was identified as *Aëdes argenteus*, Poir. (*aegypti*, auct.). It appears unusual for vessels of the modern type to harbour this species.

Pannewitz (E.). **Ueber die Toxizität von Mineralölkombinationen mit ätherischen Oelen bei Insektenvertilgungsmitteln mit Petroleumbasis.** [On the Toxicity of the Combinations of Mineral Oils with essential Oils in Insecticides with a Petroleum Basis.]—*Z. Desinfekt.*, xxiii, no. 8, pp. 339–342. Dresden, August 1931.

This paper records the results of experiments on the insecticidal power of a number of essential oils in "fly-sprays". In tests against adult mosquitos, 90 parts of a mineral oil refined with sulphuric acid were combined with 10 parts of one of the essential oils, or with 4 parts of the latter and 6 of salicylic methyl ester, the latter combination being also applied against flies. From the results it is concluded that it is possible to produce satisfactory sprays with a petroleum basis by adding suitable essential oils; of those effective in both combinations oil of thyme (*Thymus vulgaris*) is the least expensive.

Marlatt (C. L.). **Report** [1929–30] **of the Chief of the Bureau of Entomology.**—76 pp. Washington, D.C., U.S. Dept. Agric., 1930. [Recd. October 1931.]

F.C. Bishopp contributes a report (pp. 62–66) on work carried out under his direction in connection with insects affecting man and animals in the United States during the year 1929–30.

Studies of the native parasites and predators of blow-flies include observations on the bionomics of the Chalcid parasite, *Brachymeria fonscolombei*, Dufour, which attacks the larvae. It has been found, however, to prefer the larvae of the Sarcophagid flies to those of the more important economic species. Studies however indicate that it may be of considerable value in the control of screw-worm flies [*Cochliomyia macellaria*, F.] in small carcasses. In 10 jars in one series an average parasitism of 96 per cent. was obtained, and in six series at one time an average of 88 per cent. was shown. The percentage of parasitism increased much more in a pasture where about 8,000 adult parasites had been released over a period of two months than in pastures where no releases had been made. The pupal parasite, *Mormoniella vitripennis*, Wlk. (*abnormis*, Boh.) has not been shown to have a very considerable economic value.

Investigations of insecticides for use in destroying grubs [*Hypoderma*] in the backs of cattle [*R.A.E.*, B, xix, 34] showed that better

kills were effected when rather heavy applications of nicotine sulphate dust were made to each larva than when a general but lighter application was made to the entire back of the infested animal. In tests with a few animals, it was found that free nicotine in inert dust, applied generally at the rate of 3 oz. of 2 per cent. dust all over the back of the animal, resulted in slight toxosis. Similar tests with nicotine sulphate revealed no such reaction in the host. Studies of *Hippelates* spp. [*cf.* xviii, 251] show that they breed freely in several different materials, such as the excrement of man and animals, decaying meat and fermenting vegetable matter. By the use of large numbers of field recovery cages it has been found that they breed in the soil over large areas. The type of soil, the cultural methods employed and the cover crops turned under are all factors affecting their breeding. The use of traps decidedly reduces annoyance from the gnats and since a large percentage of those caught are gravid females, some degree of control is likely to be effected by systematic trapping. Liver and urea have been found to make a very attractive bait.

Experiments carried out to test the theory that malaria parasites are destroyed by the action of coumarin present in leguminous plants [xvi, 26; xviii, 143], and that malaria is therefore absent in areas where such plants are extensively grown, have not so far shown the ability of *Anopheles quadrimaculatus*, Say, to feed on the nectar or juices of these plants.

DINGER (J. E.) & SNIJDERS (E. P.). **Dengue und Gelbfieber.** [Dengue and Yellow Fever.]—*Arch. Schiffs- u. Tropenhyg.*, xxxv, no. 9, pp. 497–526, 4 figs., 9 graphs, 26 refs. Leipzig, September 1931.

An account is given of experiments in Holland in which dengue was transmitted to man by females of *Aëdes argenteus*, Poir. (*aegypti*, auct.) and *A. albopictus*, Skuse, that had acquired infection in Sumatra [*R.A.E.*, B, xix, 146, 169], and also by locally infected examples of the former. Continued experiments have led the authors to conclude that Sumatran dengue is identical with that occurring in other countries and that according to the clinical course of the cases there is no justification for differentiating it from van der Scheer's five-day fever and Rogers' seven-day fever. *Macacus rhesus* and *M. cynomolgus* were also infected by mosquitos or by injection. Some died, apparently as a result of dengue. Volunteers were not infected by mosquitos that had bitten *M. rhesus* previously infected by injection. Many examples of both monkeys failed to acquire yellow fever after one infection with dengue [xix, 234]. White mice were not susceptible to dengue even by intracerebral inoculation [*cf.* xix, 195].

SCHEVTSCHENKO (F. J.). **Die Artmerkmale der Larven von** [The specific Characters of the Larvae of] *Phlebotomus papatasii*, *Phl. chinensis*, *Phl. sergenti*, **und** *Phl. caucasici* (**Marzinovsky**) **s.** *li* (**Popoff**).—*Arch. Schiffs- u. Tropenhyg.*, xxxv, no. 9, pp. 526–537, 16 figs. Leipzig, September, 1931.

Characters distinguishing the eggs and larvae of all instars of *Phlebotomus papatasii*, Scop., *P. chinensis*, Newst., and *P. sergenti*, Parr., are described. The eggs and larvae of *P. caucasicus*, Marz. (*li*, Popov) cannot be differentiated from those of *P. sergenti*.

Gil Collado (J.). **Sobre la domesticidad de las especies españolas de *Phlebotomus* (Dipt. Psychod.).** [On the Domesticity of the Spanish Species of *Phlebotomus*.]—*Bol. Soc. españ. Hist. nat.*, xxxi, no. 7, pp. 505–507, 2 refs. Madrid, July 1931.

Elvira has stated that in the basin of the Ebro *Phlebotomus perniciosus*, Newst., is as domestic a species as *P. papatasii*, Scop. [*R.A.E.*, B, xix, 131]. The author records observations in several parts of Spain showing that it is not abundant in houses and is often found in places where it is quite independent of man. Other species found in Spain in similar conditions are *P. parroti*, Adl. & Thdr., *P. ariasi*, Tonn., and *P. sergenti*, Parr.

[Pavlovskiĭ (E. N.).] **Павловский (Е. Н.). Animal Parasites of the human Eye.** [*In Russian.*]—*In* [Bellyarminov (L. G.) & Mertz (A. I.).] **Беллярминов (Л. Г.) и Мерц (А. И.).** *Glazn. Bolezni, Ch. ii spetz.*, Glava 30 [*Eye Diseases, Pt. ii spec.*, Chapt. 30], pp. 987–1006, 21 figs., 11 refs. Leningrad, Prakt. Meditzina [1931].

This chapter from a general work on the diseases of the human eye includes eight pages devoted to the Arthropods that have been recorded as infesting or otherwise injuring the eyes.

Nash (T. A. M.). **The Relationship between *Glossina morsitans* and the Evaporation Rate.**—*Bull. Ent. Res.*, xxii, pt. 3, pp. 383–384, 1 graph. London, September 1931.

A comparison of the figures representing the mean monthly evaporation rates taken at Kikori Entomological Station, Tanganyika Territory, with the figures for the mean monthly apparent fly density of *Glossina morsitans*, Westw., taken on the North East Kikori Round over a period of 18 months, shows a distinct inverse correlation between their seasonal fluctuations. The evaporation rate is itself correlated with temperature, wind and humidity.

Swynnerton (C. F. M.). **Annual Report, Department of Tsetse Research, Tanganyika Territory, for the year ended 31st December, 1930.**—Med. 8vo, 48 pp., 7 pls., 1 graph. Dar-es-Salaam, Govt. Printer [1931]. Price 2*s*. 6*d*.

This interesting report, which should be read in the original, gives an account of the work carried out during the year 1930 on the numerous projects comprised in the investigation on the control of tsetse-flies [*Glossina*] in Tanganyika Territory [*cf. R.A.E.*, B, xviii, 263]. The summary gives some idea of the wide scope of the research that is being undertaken and of the progress that has been made. The rapid growth and increase in density of incipient thicket in the areas experimentally protected from fire has been remarkable, and it is believed that the natural thicket barrier thus formed is likely to be the only cheap and permanently effective form of obstacle that it will be possible to erect against *Glossina morsitans*, Westw., and *G. swynnertoni*, Aust., advancing on broad fronts through great bush areas. Studies of fly belts carried out during the last three years have shown them to be divided into communities, seasonal or semi-permanent

and often much separated, and these are again divided into breeding and resting grounds and feeding grounds. Moreover, the types and sub-types of country that are important, less important and of no importance, in each connection and for each fly, are being recognised, as well as the changes in density and distribution that are produced by season, game movements, etc.

FONQUERNIE (—). **Quelques considérations sur la peste à Tananarive. (Epidémiologie, clinique, traitement.)**—*Ann. Méd. Pharm. col.*, xxix, no. 2, pp. 246–286. Paris, 1931.

The author discusses the whole question of plague in the region of Tananarive, Madagascar, since its introduction in 1921 [*cf. R.A.E.*, B, xviii, 250], using the annual reports of the Bureau of Statistics and his own observations for a period of four years. Regarding the influence of the flooding of the rice-fields on the prevalence of rats in dwellings [*cf.* xvii, 203], it is pointed out that in Tananarive, for the past four years at least, the maximum number of rats has been caught in May-July before flooding takes place. Fleas are very abundant at all times in the year, and previous observations on their prevalence have been confirmed, *Xenopsylla cheopis*, Roths., being the most numerous. In infected huts the author collected *Pulex irritans*, L., *Echidnophaga gallinacea*, Westw., and *Tunga* fairly frequently, as well as small numbers (about 2 per cent.) of *X. cheopis*, which was not found in uninfected houses. The extreme scarcity of plague among rodents (at least in the form recognisable by the ordinary methods of examination) leads the author to conclude that there is no numerical relation between it and plague in man.

FULCONIS (—). **La peste au Sénégal en 1929.**—*Ann. Méd. Pharm. col.*, xxix, no. 2, pp. 286–311. Paris, 1931.

A detailed account is given of the incidence of plague in Senegal during 1929 [*cf. R.A.E.*, B, xix, 86] and the measures taken for its control. Fleas were as numerous in Saint Louis as in the villages, the proportions being *Xenopsylla cheopis*, Roths., 65 per cent., *Pulex irritans*, L., 26 per cent. and *Ctenocephalides* (*Ctenocephalus*) 9 per cent. In view of the apparent absence of rats, experiments were undertaken to test the hypothesis that fleas are the reservoirs of the plague bacillus. Inoculation of mice with emulsions of fleas from infected dwellings gave only one positive result out of five, and the author concludes that even in an infected place where fleas that are potential vectors abound, it is rare to find a conjunction of factors that will assure the transmission of plague bacilli from an infected to a healthy individual.

MARQUE (—). **La peste dans la circonscription de Dakar et dépendances en 1929.**—*Ann. Méd. Pharm. col.*, xxix, no. 2, pp. 311–317. Paris, 1931.

An account is given of the incidence of plague in the region of Dakar (Senegal) during 1929 and the measures taken for its control. Native huts cannot be tightly closed, and small scale experiments supported ihe suggestion that the fumigation of such places by means of burning

sulphur should be abandoned, for the rats are not killed on the spot, with the result that their fleas, which are even more resistant to fumes of sulphur that are not sufficiently concentrated, may become further distributed.

LONG (J. D.). **Cooperative Campaign for the Eradication of Plague in Peru. Final Report.**—*Publ. Hlth. Rep.*, xlvi, no. 37, pp. 2161–2168. Washington, D.C., 11th September 1931.

A brief account is given of the campaign against plague inaugurated in Peru in October 1930, which was based on measures against rats. With the single exception of an infected mouse, no animal other than rats was found to suffer from the disease. The most common rat is *Mus norvegicus*, although large numbers of *M. rattus* and *M. rattus alexandrinus* also occur. All of these may be infected with plague and also harbour *Xenopsylla cheopis*, Roths., the flea generally responsible for its dissemination. Several species of fleas were taken, of which two were possibly new. The highest flea index was found at Pacasmayo. This was reduced from 34 per rat to less than 4 ; in Lima from 8 per rat to less than one ; and in the country as a whole by 80–90 per cent. In a number of towns there has been a marked decrease in the prevalence of fleas, when compared with the number previously found there. This fact has been observed in other countries and generally coincides with a decrease of from 50 to 60 per cent. in the number of rats ; it serves, to a certain extent, as evidence of the successful use of poison.

RADFORD (C. D.). **Observations on the Tick,** *Ornithodorus moubata* **Murray.**—*North Western Nat.*, vi, no. 3, pp. 155–158. Arbroath, September 1931.

In the course of laboratory observations on *Ornithodorus moubata*, Murr., two female ticks confined with a male produced 150–200 eggs during the second half of November. These hatched between 12th December and 5th January. A decrease in temperature from 72–80° F. to 60–70° F. retarded the development of the ticks, each instar lasting 28–35 days instead of 16–18. An increase to 86° F., with an increase in the bulk of sand in and around the test tubes in which the ticks were kept, shortened this period to 15 days.

[PAVLOVSKIĬ (E. N.).] **Павловский (Е. Н.). On some new Habitats of** *Ornithodorus papillipes* **and the Central Asiatic Vectors of Tick-borne Relapsing Fever.** [*In Russian.*]—*Mag. paras. Mus. zool. Acad. Sci. URSS.*, ii, 1931, pp. 23–34, 3 figs., 17 refs. Leningrad, 1931. (With a Summary in German.)

The distribution of *Ornithodorus papillipes*, Bir., and *O. lahorensis*, Neum., in eastern Uzbekistan is further discussed [*cf. R.A.E.*, B, xviii, 7]. Both species were also found in a living room in a town in the west of the Kirghiz Republic, and *O. papillipes* alone in single localities in Daghestan, and central and western Turkmenistan. The two observations in Turkmenistan were of special interest, as the ticks occurred in the wall of a mausoleum and in soil taken from a ravine, in which were burrows, possibly of rodents. This shows that

human dwellings and neighbouring outbuildings are not the specific habitat of *O. papillipes*, and that it may exist independently of man or domestic animals. In another instance, it occurred in a cave in western Tadzhikistan in which porcupine quills were found. Though none of these ticks harboured relapsing fever spirochaetes, the possibility of their becoming infected from rodents and transmitting the disease to man is evident. Spirochaetes of central Asiatic relapsing fever were experimently transmitted to a hedgehog and rodents by the bites of *O. papillipes*.

Evidence is adduced to show that the ticks recorded in this connection as *O. lahorensis* [xiv, 193; xv, 51, 95, 215; xix, 54] were in fact *O. papillipes* [*cf.* xvi, 110; xvii, 226].

Blanc (G.) & Caminopétros (J.). **Quelques expériences sur la transmission du kala-azar par la tique du chien** *Rhipicephalus sanguineus*.—*C.R. Soc. Biol.*, cvii, no. 26, pp. 1493–1495. Paris, 18th September 1931.

Further successful experiments on the infection of *Rhipicephalus sanguineus*, Latr., with Mediterranean kala-azar, by feeding on a naturally infected dog and a ground squirrel (*Citellus citellus*) artificially infected from man confirm the results previously obtained [*R.A.E.*, B, xix, 39] and also show that experimental infection of ground squirrels by inoculation of infected ticks may not become manifest for 7–8 months. Thus the fact that attempts to transmit the disease by the bites of ticks were unsuccessful is not considered significant, as the animals on which they fed were killed and examined after only 3 months. Ticks infected by feeding on an infected animal may remain infective for at least 21 days, even after digestion and moulting have taken place, which suggests that the tick is the true intermediate host of the parasite and not simply a mechanical vector.

Spencer (R. R.). **Expansion of Investigations on Tick-borne Diseases by the United States Public Health Service.**—*Publ. Hlth. Rep.*, xlvi, no. 36, pp. 2097–2101. Washington, D.C., 4th September 1931.

The author briefly reviews some of the work of the United States Public Health Service carried out during the past 6–7 years in connection with tularaemia and Rocky Mountain spotted fever, and discusses the investigations on these diseases, tick paralysis and Colorado tick fever that will be undertaken in the reconstructed laboratory at Hamilton, which has recently been purchased from the State of Montana [*cf. R.A.E.*, B, xvii, 129]. Colorado tick fever presents an interesting problem. This disease seems always to be preceded by the bite of a tick, its seasonal appearance is coincident with the appearance of ticks in the spring, and the prodromal symptoms resemble very closely those of Rocky Mountain spotted fever. It differs from the latter in that it is rarely if ever fatal, it produces no rash, and the sera of cases do not give a positive Weil-Felix reaction. It is not known whether this condition represents a mild form of Rocky Mountain spotted fever or whether it is a distinct disease hitherto undescribed. *Dermacentor venustus*, Banks (*andersoni*, Stiles) transmits Rocky Mountain spotted fever, tularaemia, tick paralysis and Colorado tick fever.

DYER (R. E.), CEDER (E. T.), RUMREICH (A.) & BADGER (L. F.). **Experimental Transmission of Endemic Typhus Fever of the United States by the Rat Flea** (*Xenopsylla cheopis*).—*Publ. Hlth. Rep.*, xlvi, no. 41, pp. 2415–2416, 5 refs.

DYER (R. E.), CEDER (E. T.), LILLIE (R. D.), RUMREICH (A.) & BADGER (L. F.). **The experimental Transmission of Endemic Typhus Fever of the United States by the Rat Flea** *Xenopsylla cheopis*.—*T.c.*, no. 42, pp. 2481–2499, 2 pls., 9 charts, 16 refs. Washington, D.C., 9th & 16th October 1931.

In the first paper, a brief account is given of further experiments on the transmission of endemic typhus [Brill's disease] by the rat flea, *Xenopsylla cheopis*, Roths. [*cf. R.A.E.*, B, xix, 221] in which infected fleas were placed with healthy rats in cages without infected rats. The virus recovered from the originally healthy rats was shown by various methods such as subinoculations, cross-immunity tests, etc., to be that of endemic typhus. The virus was found to be present in the flea for at least nine days after feeding on infected rats, and has also been recovered from the faeces of infected fleas.

The second paper contains detailed accounts of the individual experiments, the results of which are noticed above and in the previous paper [*loc. cit.*].

BAIRD (W. H. W.). [**Veterinary entomological Research.**]—*Ann. Rep. Dept. Vet. Sci. Anim. Husb. Tanganyika Terr. 1930*, pp. 43–48. Dar-es-Salaam, 1931.

During the year, further observations were made on the hand-dressing of goats as a means of controlling *Sarcoptes caprae*, Fürst. [*R.A.E.*, B, xix, 99], and it is concluded that goats properly treated with this oil, sulphur and tar dressing recover completely from mange and do not carry a latent infection and further, that infection dies out in a house when the disease is cured in the animals. Although recovery confers no actual resistance to re-infestation, the skin is not affected to the same extent as it is during a first attack. Age appears to confer a somewhat similar resistance. In an experiment to test the value of hand-dressing as compared with dipping in Cooper's Cattle Dip (1 : 200), eight applications of the ointment effected a cure, but eight immersions in the dip, while ameliorating the general conditions of the affected animals, did not cure them. During the year 16 flocks were successfully treated by hand-dressing.

Observations on the larvae of *Oestrus ovis*, L., in sheep are described, from which it is concluded that they require for their full development a minimum of seven months and a maximum of ten.

In view of the failure of attempts to transmit *Trypanosoma brucei* mechanically by means of *Stomoxys* [*calcitrans*, L.] [*loc. cit.*], a number of these flies were dissected after feeding on an infected guineapig in order to determine the reason. Trypanosomes were not found in the proboscis but they were numerous in the alimentary canal, and it is concluded that the blood passes rapidly and completely through the proboscis and that there is no regurgitation on the resumption of feeding after interruption.

Individuals of *Hippobosca francilloni*, Leach, taken on a trapped leopard, were fed for two minutes on rats infected with *Trypanosoma brucei* and subsequently allowed to complete their feed on an uninfected rat. Slides made regularly from this rat showed no trypanosomes up to one month after the completion of the experiment.

HOFFMANN (C. C.). **Los Simulidos de la region onchocercosa de Chiapas. Segunda parte.**—*An. Inst. Biol. Univ. Mexico*, ii, no. 3, pp. 207–218, 18 figs., 6 refs. Mexico, 1931.

This further study of the Simuliids of the Chiapas coffee zone [*R.A.E.*, B, xix, 113] discusses the classification of *Simulium avidum*, Hoffm., *S. virgatum chiapanense*, Hoffm., *S.* (*Eusimulium*) *mooseri*, Dampf, and *S.* (*E.*) *ochraceum*, Wlk. The eggs and larvae of all these occur in fast running water with vegetation. In the dry season the level of streams falls, and most of the plants on their edges wither. The larvae then decrease in numbers and occur among stones in shallow water with a not too rapid flow. Such larvae are dark in colour, and the pupae also are dark. The larvae of *S. avidum* appear to be the ones best adapted to existence among stones, 88 per cent. of the pupae there being of this species. Characters for distinguishing the larvae and pupae of the four species are given.

SEDDON (H. R.). **Conditions which predispose Sheep to Blowfly Attack.**—*Agric. Gaz. N.S.W.*, xlii, pt. 8, pp. 581–594, 6 figs. Sydney, 1st August 1931.

The normal conditions that predispose sheep to blow-fly attack, as described in this paper, have been more fully discussed in one already noticed [*R.A.E.*, B, xix, 224]. There are also certain abnormal circumstances, largely resulting from moisture factors, that tend to induce attack ; these include water-rot of the wool, which is associated with bacteria of various kinds, and mycotic dermatitis, caused by a fungus. Bacterial decomposition can be eliminated to some extent by crutching, and the breeding of strains of sheep that do not show excessive wrinkling of the skin would probably be of great value. Dressing wounds with antiseptics and marking young lambs in such a way that smaller wounds are caused minimise fly attack. Attempts are being made to devise a dip that will kill bacteria without damage to the wool or the skin.

DINULESCU (G.). **Une larve d'oestride produisant des tumeurs dans le duodénum des chevaux en Espagne.**—*C.R. Acad. Sci. Fr.*, cxciii, no. 14, pp. 550–552, 5 figs., 1 ref. Paris, 1931.

Oestrid larvae, very similar morphologically to those of *Gastrophilus* (*Oestrus*) *meridionalis*, Pill. & Evans, which infest the stomach of zebras in Rhodesia [*R.A.E.*, B, xiv, 180], are recorded from a slaughter-house in Vaugirard, attached to the duodenum of horses from Spain. As many as 20 larvae may be found in one tumour, which may reach the size of a hen's egg.

[KVASNIKOVA (P. A.).] **Квасникова (П. А.). Flies observed in human Dwellings and Outhouses in the Town of Tomsk.** [*In Russian.*]—*Wiss. Ber. biol. Fak. Tomsk. St.-Univ.*, i, no. 1, pp. 9–47, 8 diag., 25 refs. Tomsk [1931].

Observations during three years were carried out in western Siberia on the flies that occurred in and near inhabited houses, special attention being devoted to *Musca domestica*, L. Altogether about 150 species of Brachycera were observed, of which 84 have been identified ; a list of these is given, with indications of the place and date of capture, and in many cases brief notes on bionomics. The kinds of places in the town of Tomsk in which the various species were found are discussed. Among the blow-flies collected in meat, *Calliphora erythrocephala*, Mg., completed its development under favourable conditions in 34 days. Larvae hatching from eggs placed in horse dung all died in the first instar. The larvae are thought to be predacious on those of *M. domestica*, as none of the latter were found on a piece of meat on which both species had oviposited. *Muscina stabulans*, Fall., was especially abundant in the second half of the summer in cesspools, a refuse dump, and meat, fish and fruit shops. Contrary to observations by Porchinskiĭ [*R.A.E.*, B, i, 109], it was never found breeding in horse dung, and the larvae that hatched from eggs placed in this medium did not survive. The life-cycle from egg to adult was completed in 33–38 days. Hibernation occurred in cracks in the walls and ceiling of cellars and uninhabited basements, reactivation beginning at the end of May. Only females were found hibernating, all being presumably fertilised, as those taken into the laboratory oviposited in 9–11 days.

The biology of *M. domestica* is discussed at length. Most of the flies occurred in inhabited rooms, kitchens and bakers' and butchers' shops, though they bred chiefly in horse dung in stables and in much smaller numbers in cesspools, latrines and a refuse dump. Contrary to data in the literature, experiments with coloured fly-papers showed that the flies were particularly attracted by sky blue, followed by white, dark blue, yellow and orange. Temperature had a marked effect on the emergence and flight of the adults, which disappeared at 10–12° C. [50–53·6° F.]. Under cage conditions, development was completed in 13 days at 23–24° C. [73·4–75·2° F.], as compared with an average of 20–31 days at 20° C. [68° F.]. Hibernation occurs in the adult stage ; in some houses the flies reappeared in numbers at the end of March. The majority of the females contained mature eggs ; probably they are already fertilised when hibernation takes place. In some instances the flies remained active and increased in numbers throughout the winter. In 1928, owing to a cold spring, they did not appear in the open before June.

Observations on the occurrence of dysentery in Tomsk showed that there is a direct relation between the abundance of *M. domestica* in houses and in the open and the number of cases of the disease.

CALER (H. L.). **Volck Special Emulsion Number 2 as a Control for External Parasites of Animals.**—*J. Kansas Ent. Soc.*, iv, no. 4, pp. 77–98, 3 refs. McPherson, Kans., October 1931.

This paper summarises the results of four years' experiments with a special emulsion of volck oil against various parasites of man and

animals, many of which have been noticed from previous reports [*R.A.E.*, B, xvii, 25; xviii, 21]. Further experiments with dogs and cats showed that a 10 per cent. emulsion thoroughly applied as a spray, dip or wash, eliminated all fleas (*Ctenocephalides* (*Ctenocephalus*) spp.) but did not prevent re-infestation in a few days. The animals should be bathed in soap and water one day after treatment to remove the excess of oil from the coat, which otherwise becomes matted with dust and dirt. High concentrations in both water and alcohol gave unsatisfactory results against *Notoedres cati*, Hering (head mange mite) on cats. No viable eggs of *Haematopinus suis*, L., were taken from pigs 2 days and 16 days after dipping in 10 per cent. emulsion at 80° F., whereas 90 per cent. of the eggs removed before treatment were viable. No adults or nymphs were found 21 days after dipping. No adults, nymphs or eggs were found 25 days after spraying pigs with the same concentration [*cf.* xviii, 21]. Pigs infested with *Sarcoptes suis*, Gerl., were treated with a 10 per cent. emulsion of volck made with water to which 40 per cent. nicotine sulphate had been added at the rate of $\frac{1}{8}$ fluid oz. per U.S. gallon; skin scrapings taken 4 and 9 days after treatment showed the presence of oil but no mites. Subsequent scrapings at intervals of three days for three weeks were also negative, and the pigs improved steadily in health and weight.

Following on experiments by Bruce [xvii, 25], a herd of cattle infested with *Linognathus vituli*, L. (long-nosed ox louse), *Haematopinus eurysternus*, Nitz., and *Bovicola bovis*, L. (*Trichodectes scalaris*, Nitz.) was sprayed with a 10 per cent. emulsion, using about $1\frac{1}{4}$ U.S. qts. per animal. Three days later it was estimated that a control of 95 per cent. had been obtained on some of the larger animals and 70 per cent. on the others. A second treatment, using $2\frac{1}{4}$ U.S. qts. per animal, gave a mortality of 90 per cent. A control of 85–95 per cent. was obtained on several herds of range cattle. No living lice could be found on a dairy herd examined on the day after treatment with a 10 per cent. emulsion using 2 U.S. qts. per animal; the success of this experiment is attributed partly to the fact that the nearly solid stream spray employed reached the lice more successfully than the broad cone spray, which was unable to penetrate the matted hair. Laboratory experiments with adults of *B. bovis* and *L. vituli* showed that the latter are much more resistant to volck than the former. Eggs of *B. bovis* dipped in 10 per cent. emulsion of volck for 1 minute were all killed.

Two horses heavily infested with *Trichodectes equi*, L., were treated with a 10 per cent. emulsion of volck applied as a spray and rubbed in with brushes, using 8 U.S. qts. per animal. After four days one animal was free from infestation, but a few lice were found on the other (about 95 per cent. control). The coats of the horses, which had been rough and harsh, were greatly improved by this treatment.

A new Method of protecting the Dairy Barn from Flies.—*Health News*, viii, no. 33, p. 143. Albany, N.Y., 17th August 1931. (Abstract in *Publ. Hlth. Engng. Abst.*, xi, p. Mi: 36. Washington, D.C., 3rd October 1931.)

A method of keeping dairy barns free from flies by the installation of electrified screens is being developed in New York by D. L. Collins.

The upper panels of the doors consist of copper wires woven alternately across an insulated framework and spaced about $\frac{1}{4}$ in. apart. The screens are supplied with a high tension static charge of electricity of approximately 3,500 volts and less than 0·05 milliampères by a transformer, which operates on an ordinary 110–115 volt 60–cycle lighting circuit and draws less than 0·2 ampères, a charge harmless to man but fatal to insects. When the doors are closed, flies that attempt to enter are instantly electrocuted. Some, however, may gain entrance when the doors are opened to let the cattle in and out or while the stable is being cleaned. These may be driven against the wires when the doors are again closed by a repellent spray. As many as 15,000 or 20,000 flies have been killed in this manner on a warm summer day.

Classen (A. G.). **Proper Drainage as a Means of Mosquito Abatement.**—*Municipal Sanitation*, ii, no. 5, pp. 223–226. *Sine loco*, May 1931. (Abstract in *Publ. Hlth. Engng. Abst.*, xi, p. Ma : 30. Washington, D.C., 3rd October 1931.)

The drainage of marshes and their protection from back-flow is not only one of the most effective means of mosquito eradication, but also one of the most productive forms of reclamation. The first measure usually consists in erecting a dike between the land to be reclaimed and a river, or other body of water, that is a natural outlet. Sluices provided with gates to prevent back-flow are placed at the lowest points of the dikes to permit drainage. A cast iron automatic gate, with a doubly hinged shutter, sensitive to slight changes in water level, is recommended. After it is drained, large cracks may be produced in the reclaimed area, owing to shrinkage of the enclosed surface ; the water which accumulates in these is difficult to drain and affords an ideal breeding-place for mosquitos. The most effective way of overcoming this difficulty is to plough the land and fill the cracks by disking and dragging.

Williams (C. L.). **Report on some Tests of the Use of a new Cyanogen Product in Ship Fumigation.**—*Publ. Hlth. Rep.*, xlvi, no. 35, pp. 2048–2059, 2 pls. Washington, D.C., 28th August 1931.

An account is given of experiments carried out in New York, both in the laboratory and on board ship, to determine the value for fumigating purposes of HCN in the form of " HCN Discoids " as compared with such substances as Zyklon. The discoids consist of thin, circular disks of wood pulp, each impregnated with about $\frac{1}{4}$ oz. HCN with 5 per cent. chloropicrin. The tests indicate that the concentration of HCN produced under similar conditions is practically identical for both products. The discoids probably retained a greater amount of HCN after use than the Zyklon residue, but this does not seem sufficient to be a source of danger, and the fact that they also retain chloropicrin for a longer time gives a greater margin of safety. Moreover, they provide a means of measuring more accurately the dosage of HCN for small compartments.

PAPERS NOTICED BY TITLE ONLY.

REGENDANZ (P.). **Das exanthematische Zeckenfieber. (Fièvre boutonneuse de Tunisie—Fièvre exanthématique de Marseille—Fièvre exanthématique d'été de Maroc—Febbre errutiva del Carducci.)** [A review of the literature.]—*Arch. Schiffs- u. Tropenhyg.*, xxxv, no. 9, pp. 549–554, 22 refs. Leipzig, September 1931.

KRÖBER (O.). **Neue süd- und mittelamerikanische Arten der Dipterengattung** *Tabanus* **L.** [New South and Central American Species of the Dipterous Genus *Tabanus*.]—*Stettin. ent. Ztg.*, xcii, no. 2, pp. 275–305. Stettin, 1931.

VOLLMER (O.). **Kleidermotten als Fresser lebender Zecken.** [Clothes Moths (*Tineola bisselliella*, Humm.) as Feeders on living Ticks (*Ornithodorus moubata*, Murr., and *Argas persicus*, Oken.).]—*Z. angew. Ent.*, xviii, no. 1, pp. 161–174, 4 figs. Berlin, June 1931. [See *R.A.E.*, A, xix, 700.]

AUSTEN (E. E.). **A new Species of Warble-fly (Diptera—Family Tachinidae, Subfamily Hypoderminae, Genus** *Hypoderma*) [*H. aeratum*, sp. n.], **which attacks Goats in Cyprus.**—*Bull. Ent. Res.*, xxii, pt. 3, pp. 423–429, 5 figs., 3 refs. London, September 1931.

BUXTON (P. A.). **The Measurement and Control of atmospheric Humidity in Relation to entomological Problems.**—*Bull. Ent. Res.*, xxii, pt. 3, pp. 431–447, 9 figs., 23 refs. London, September 1931. [See *R.A.E.*, A, xix, 712.]

BISHOPP (F. C.). **Fleas and their Control.**—*Fmrs'. Bull. U.S. Dept. Agric.*, no. 897 revd., 15 pp., 5 figs. Washington, D.C., April 1931. [*Cf. R.A.E.*, B, xiv, 222.]

BISHOPP (F. C.). **The Stable Fly** [*Stomoxys calcitrans*, L.] : **How to prevent its Annoyance and its Losses to Livestock.**—*Fmrs'. Bull. U.S. Dept. Agric.*, no. 1097 revd., 17 pp., 11 figs. Washington, D.C., April 1931. [*Cf. R.A.E.*, B, viii, 189.]

PHILIP (C. B.). **Occurrence of a Colony of the Tick Parasite** *Hunterellus hookeri* **Howard in West Africa.**—*Publ. Hlth. Rep.*, xlvi, no. 37, pp. 2168–2172, 5 refs. Washington, D.C., 11th September 1931. [For shorter account see *R.A.E.*, B, xix, 172.]

BRUG (S. L.). **New Culicidae** [Four new species of Culicines] **from Sumatra.**—*Tijdschr. Ent.*, lxxiv, no. 2–3, pp. 245–250, 4 figs. Amsterdam, 1st September 1931.

SCHWETZ (J.). **Notes morphologiques sur les trypanosomoses animales de Stanleyville et du Congo oriental.**—*Ann. Paras. hum. comp.*, ix, no. 5, pp. 392–422, 10 figs., 8 refs. Paris, 1st September 1931.

KRÖBER (O.). **Neue neotropische Tabaniden aus den Unterfamilien Bellardiinae und Tabaninae.**—*Rev. Ent.*, i, fasc. 4, pp. 400–417, 18 figs. São Paulo, 14th November 1931.

[PAVLOVSKIĬ] PAWLOWSKY (E. N.) & STEIN (A. K.). **Experimentelle Untersuchung über die Wirkung des Bisses von** *Periplaneta orientalis* **auf die Menschenhaut.** [An experimental Investigation on the Effect on the human Skin of the Bite of *Blatta orientalis*, L.] —*Arch. Derm. Syph.*, clxii, no. 3, pp. 611–620, 7 figs., 17 refs. Berlin, 1931.

INDEX OF AUTHORS.

A reference in heavy type indicates that a paper by the author has been noticed.

GENERAL INDEX.

In the case of scientific names the page reference is cited only under the heading of the generic name.

When a generic name is printed in brackets it signifies that the name is not the one adopted.

A.

* This record presumably refers to *A. minimus* or *A. listoni*.

B.

C.

D.

E.

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H.

* An error for *H. aeratum*.—Ed.

J.

K.

L.

M.

* For relation to disease see under Blackwater Fever, Dengue, Filariasis, Fowl-pox, Malaria, Poultry Typhus, Rift Valley Fever, Van der Scheer's Fever, Yellow Fever.

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